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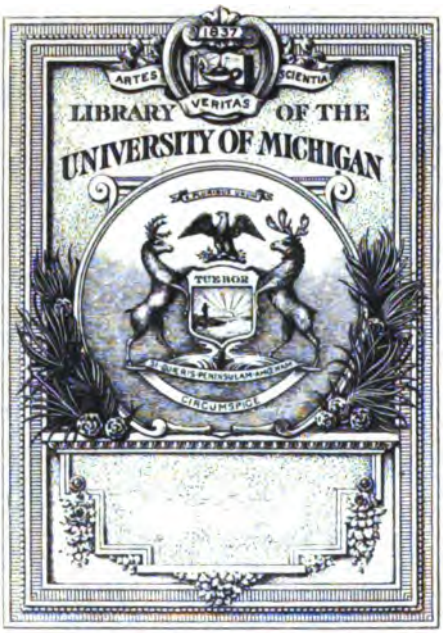
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Scott, Robert

SCOTT'S

PRACTICAL

COTTON SPINNER,

AND MANUFACTURER;

OR THE

MANAGERS', OVERLOOKERS', AND MECHANICS' COMPANION.

BEING A COMPREHENSIVE SYSTEM OF

CALCULATIONS OF MILL GEERING AND MACHINERY,

From the first moving Power, through all the different processes of

CARDING, DRAWING, SLUBBING, ROVING, SPINNING, AND WEAVING,

With the recent improvements in Machinery.

TO WHICH ARE ADDED,

Compendious Tables of Yarns and Reeds, for persons engaged in the Spinning and Manufacturing of Silk, Linen, Worsted and Woollen.

THIRD EDITION, ENLARGED, WITH PLATES.

LONDON:
SIMPKIN, MARSHALL, & CO.; LONGMAN, BROWN, & CO.;
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PREFACE.

SEVERAL publications on Cotton Spinning have already appeared before the public, the merits of which it is not my intention to discuss. As a practical person I may however observe, that those which have come under my notice are, to a considerable extent, destitute of much practical utility. The systems of working the calculations they contain are not sufficiently explicit, and hence can never achieve the great and important end of combining practice with theory, which is so essential, particularly to managers and overlookers.

The present work comprises every necessary calculation connected with the most recent improvements in machinery in the spinning and manufacturing business, with rules, examples, and illustrations, simple and easy to be understood; so that any person, having a knowledge of the elementary rules of arithmetic, may, without difficulty, by attention to the rules and examples given, prepare himself for filling the most important situations as overlooker, or manager in any department of the business. The rules and examples are all original and have been reduced to practice by myself.

Calculations relative to all machinery, used in the spinning and manufacturing of all fibrous substances, are attainable by the same rules, so that this work will be found equally beneficial to those engaged in the spinning and manufacturing of Silk, Linen, Worsted, and Woollen; compendious tables being arranged, with rules, examples, and illustrations, to shew the size, girt, hank, or proportion of

hank, in every operation, with the fineness of Yarns according to the different lengths, constituting the lea, cut, or hank, with the different systems of counting worsted Reeds.

Having been engaged in the different departments of the Cotton business for many years, I have found a great deficiency in theoretical knowledge amongst practical persons filling important situations in Cotton and other Factories, which led to the determination, at the request and by the encouragement of several friends, to prepare a complete system of calculations: and I have no hesitation in saying that such a system will be found in the present work. And while it answers as a book of reference to the masters, and an assistant to the manager, overlooker, and mechanic, it will convey instructions to the aspiring operative, and form a desideratum in the tuition of young persons intended for the spinning, manufacturing, or machine business. This work will not only be found to convey a correct knowledge of calculations, but in following out the rules laid down, a considerable degree of pleasure must be experienced from a perception that theory and practice are here combined, which it is hoped, will enable persons to give general satisfaction in the management of their respective departments of business.

R. SCOTT.

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SCOTT'S

Practical

COTTON SPINNER AND MANUFACTURER.

ERRATA.

Page 26, line seventh, for corner, read cover.
Page 27, second line of Question, for 1535, read 1435.

Multiply the strokes of the steam engine, or revolutions of the water wheel, by the number of teeth in the wheel fixed on the first moving power, or given shaft, for a dividend, and divide by the number of teeth in the wheel fixed on the intended driven shaft, and the quotient will be the speed or revolutions of shaft required.

To find the speed of any given shaft, when the speeds of the intermediate shafts are not required.

Multiply all the driving wheels together respectively, so far as the shaft you want the speed of, and that product by the strokes of the engine, the revolutions of the water wheel, or any shaft: the speed

being known for a dividend, then multiply all the driven wheels together accordingly, for a divisor, and the quotient will be the speed, or revolutions of the shaft required.

If a steam engine makes 22 double strokes per minute, i. e., the crank revolving so many times, with a wheel fixed on the crank, or by shaft, containing 136 teeth: what revolutions will the first or main line of shafts make, if the wheel with 136 teeth works into a wheel on the first or main line of shafts with 47 teeth?

22 strokes or revolutions of engine per min.
136 teeth in wheel of crank or fly shafts.

132
22

Wheel on main line of shaft 47) 2332 (49,617 revolutions per minute of first or main line of shafts.
188

452
423

290
282

80
47

330
329

1

If a wheel with 61 teeth be fixed on the first or main line of shafts, which makes 49,617 revolutions per minute; what revolutions per minute will a cross shaft make with a wheel 57 teeth fixed on it, worked by the wheel with 61 teeth?

49,617 revolutions of shaft per minute.
61 teeth in wheel or shaft.

49617
297702

3026,637 *Carried to next page.*

Wheel on cross shaft 57 teeth) 3026,637 (53,098894 revolutions of cross shaft per minute, or nearly 53,1.

285

176
171

563
513

507
456

510
456

540
513

270
228

42

If a wheel with 75 teeth be fixed on a shaft revolving 49,617 times per minute, works into a wheel with 41 teeth, fixed on a shaft for driving looms; what number of revolutions will it make per minute?

49,617 revolutions of shaft per minute.
75

248085
347319

Wheel on shaft for driving looms } teeth. 41) 3721,275 (90,7628 revolutions per minute of shaft driving looms.

369

312
287

257
246

115
82

330

330
328

2

If a wheel with 52 teeth be fixed on a shaft making 90,7626 revolutions per minute, works into a wheel with 41 teeth, on the foot of an upright shaft for driving mules; what revolutions per minute will the upright shaft make?

90,7628 revolutions of shaft per minute.
52 teeth wheel on do.

1815256
4538140

Wheel on foot of upright shaft, } teeth. 41)47196656(115,1138 revolutions per minute of upright shaft, driving mules.

41
61
41
209
205
46
41
56
41
155
123
326
328—nearly.

If a drum, 20 inches diameter, be fixed on an upright shaft, for driving mules, which makes 115,1138 revolutions per minute; what will the the upright shaft in wheelhouse for driving rim, or fly shaft make, if a pulley, 12 inches in diameter, be fixed on a shaft, and worked by a strap from drum 20 inches diameter?

115,1138 revolutions per minute, upright shft.
20 inches diameter of drum on do.

Diam. of pulley on upright shaft in wheelhouse, } in. 12)2302,2760

191,8563 revolutions of upright shaft per minute in wheelhouse, for driving rim shaft.

If a wheel with 61 teeth be fixed on the first or main line of shafts, making 49,617 revolutions per minute; what number of revolutions will an upright shaft make, with a wheel 57 teeth fixed on it, worked by wheel 61 teeth?

49,617 revol. per min, of main shafts.
61 teeth in wheel on do., working into wheel on foot of upright shaft.

49617
297702

Wheel on foot of upright shaft, teeth.

57)3026637(53,098894 revols. per minute of upright shafts.
285

176
171

563
513

507
456

510
456

540
513

270
228

42

If a wheel with 70 teeth be fixed on the top of an upright shaft, making 53,098894 revolutions per minute, and works into a wheel with 39 teeth on lying shaft; what revolutions will the lying shaft make per minute?

53,098894 revolutions of upright shaft per minute
70 teeth in wheel on do.

Wheel on lying shaft, teeth. 39)3716,922580(95,3057 revolutions of lying shaft per minute.

351

206
195

119
117

222
195

275
273

2

If a drum 30 inches diameter, be fixed on a shaft making 95,3057 revolutions per minute; what number of revolutions per minute will a shaft make with a drum fixed on it 18 inches diameter, worked by a strap from drum 30 inches diameter?

95,3057 revolutions of shaft per minute.
30 inches diam. of drum on do.

Diam. of drum inches. 18)285,91710(158,8428 revolutions of shaft per minute, for driving willow.

18

105
90

159
144

151
144

77
72

51

51
36

150
144

6

If a drum 45½ inches diameter, be fixed on a shaft making 95,30558 revolutions per minute; what number of revolutions per minute will a shaft make, with a pulley fixed on it 13¾ inches diameter, and driven by a strap from the drum 45½ inches diameter?

95,30558 revolutions of shaft per minute.
45,5 diameter of drum on do.

47652790
47652790
38122232

Diam. of pulley 13,75 inches. 4336,403890 (315,3748 revolutions of counter shafts per minute driving, blowing and lap machines.

4125
2114
1375
7390
6875
5153
4125
10288
9625
6639
5500
11390
11000
390

If a drum 36 inches diameter be fixed on a shaft making 315,3748 revolutions per minute; what number of revolutions will the beaters of a blowing machine make, if a pulley 6 inches diameter be fixed on the end of the beaters, and driven by a strap from the drum 36 inches diameter?—315,3748 revolutions of counter shaft per minute.
36 inches diameter of drum on do.

18922488
9461244

Diam. of pulley on beaters, 6 inches.) 113534928

1892,2488 revolutions of beaters per minute.

If a wheel with 62 teeth be fixed on a shaft making 53,098894 revolutions per minute; what number of revolutions will a shaft make with a wheel 46 teeth fixed on it, and driven by the wheel with 62 teeth?

53,098894 revolutions of given shaft per minute.
62 teeth in wheel on do.

106197788
318593364

teeth.
Wheel on shaft 46)3292,131428(71,568074 revols. of shaft per minute.
322

72
46

261
230

313
276

371
368

342
322

208
184

24

If a wheel with 63 teeth be fixed on a shaft making 71,568074 revolutions per minute; what number of revolutions will a shaft make with a wheel 45 teeth fixed on it, and driven by the wheel 63 teeth?

71,568074 revolutions of shaft per min.
63 teeth in wheel on do.

214704222
429408444

4508,788662 *Carried to next page.*

Wheel on shaft, 45 teeth.)4508,788662(100,1953 revols. of shaft per min. driving rooms.

45

087
45

428
405

238
225

136
135

1

If a wheel with 49 teeth be fixed on a shaft making 100,1953 revolutions per minute, drives a wheel 38 teeth, fixed on foot of upright shaft; what revolutions will the upright shaft make per minute?

100,1953 revol. of given shaft per min.
Wheel on shaft ☞ 49 teeth.

9017577
4007812

Wheel on foot of upright shaft, teeth.—38)4909,5697(129,2 revol. of upright shaft per minute--Spinning room.

38

110
76

349
342

76
78---nearly.

If a drum, 21 inches diameter, be fixed on an upright shaft, for driving upright shaft in wheelhouse, making 129,2 revolutions per minute; what number of revolutions per minute will the upright shaft in wheelhouse make, with a pulley 14 inches diameter fixed on it?

129,2 revol. per min. of upright shaft.
21 inches diameter of drum on do.

1292
2584

Diameter of pulley, 14 inches.)2713,2(193,8 revolutions of upright shaft in wheelhouse per minute, working rim or fly shafts.
14
131
126
53
42
112
112

If a wheel with 60 teeth, fixed on a shaft, makes 53,098894 revolutions per minute; what number of revolutions per minute will an upright shaft make, with a wheel 44 teeth fixed on foot, and driven by the wheel 60 teeth?

53,098894 revolutions per minute.
60 teeth wheel on do.

Wheel on foot of upright shaft, teeth.
44)3185,933640(72,40758 revol. of upright shaft per minute, for Dressing room.
308
105
88
179
176
333
308
256
220
364
352
12

Or thus:—

44 = 4 × 11

4)3185,93364
11)79648341
72,40758—12

If an upright shaft makes 72,40758 revolutions per minute, with a wheel 75 teeth fixed on top, working into a wheel 41 teeth, fixed on lying shaft; what revolutions per minute will the lying shaft make?

72,40758 revols. of upright shaft per min.
75 teeth wheel on do.

36203790
50685306

Wheel on lying shaft, 41 teeth.) 54,3056850 (132,4529 revolutions per min. shaft driving Dressing frames.

41
133
123
100
82
185
164
216
205
118
82
365
369---nearly.

The speed of any shaft may be obtained, without ascertaining the speeds of the intermediate shafts, according to the following rule.

RULE.

Multiply the double strokes of the steam engine, or the revolutions of any given shaft per min. by the number of teeth in the driving wheels respectively, or if drums or pulleys, by the inches in the diameters respectively, or in the place they occur, for a dividend, and all the driven wheels, drums, or pulleys, in the same manner, for a divisor, and the quotient will be the speed of the shaft required.

If the steam engine be making 22 double strokes or revolutions per minute, with the following driving and driven wheels, drums, and pulleys; what number of revolutions per minute will the shaft make which is intended to drive a blowing machine or scutcher?

DRIVING.	DRIVEN.
Revols. per min. crank or fly shaft 22	Wheel on 1st lying shaft 47 tth.
Wheel on crank or fly shaft 106 tth.	Whl. top of upright shaft 57 tth.
Wheel on first lying shaft, driving upright shaft 61 teeth.	Whl. on next lying shaft 39 tth.
Wheel on top of upright shaft 70 tth.	Diameter of pulley on shaft for driving Blowing machine 13¾ inches.
Diameter of drum on shaft 45½ inches.	

22 revolutions per minute crank or fly shaft.
106 teeth in wheel on do.

132
220

2332
61 teeth in wheel on first lying shaft, driving upright shaft.

2332
13992

142252
70 teeth in wheel on top of upright shaft.

9957640
45,5 or 45½ inches diameter of drum on shaft.

49788200
49788200
39830560

453072620,0 dividend.

47 teeth in wheel on first line of shafts.
57 teeth in wheel on foot of upright shaft.

329
235

2679
39 teeth in wheel on second lying shafts.

24111
8037

104481 *Carried to next page.*

104481
13,75 or 13¾ inches diameter of pulley on shafts for driving Blowing machines.

522405
731367
313443
104481

1436613,75 divisor.

1436613,75)453072620,0(315,375388 revolutions per minute, shaft driving Blowing machine.
430984125

220884950
143661375

772235750
718306875

539288750
430984125

1083046250
1005629625

774166250
718306875

558593750
430984125

1276096250
1149291000

1268052500
1149291000

118761500

N. B.—The small difference arising in the above system of working, is on account of working all the different speeds of shafts separately, (See former Examples.)

If a drum 45½ inches diameter, be fixed on a shaft making 315,375388 revolutions per minute; what number of revolutions will the beater of a Blowing machine make, with a pulley fixed on beater end, 10 inches diameter, and driven by a strap from the drum 45½ inches diameter?

315,375388 revolutions of shaft per minute.
45,5 or 45½ inches diameter of drum.

1576876940
1576876940
1261501552

Diameter of pul. on beater end, in. 10)14349,5801540

1434,9580154 revolutions of beater per min.

If a shaft makes 84 revolutions per minute, with a wheel of 60 teeth fixed on it, working into a wheel on a cross or upright shaft, with 52 teeth; what number of revolutions will the cross or upright shaft make?

84 revolutions of shaft per minute.
60 teeth in wheel on do.

Wheel on cross, or upright shaft, teeth. 52)5040(96,923 revols. of cross or upright shaft per minute.

468
360
312
480
468
120
104
160
156
4

If a cross or upright shaft be making 96,923 revolutions per minute, with a wheel 52 teeth fixed on it, which is driven by a wheel with 60 teeth fixed on the lying shaft; what number of revolutions will the lying shaft make per minute?

96,923 revols. per min, of cross or upright shaft.
52 teeth wheel fixed on do.

193846
484615

Wheel on lying shaft, tth. 60)5039,996(84 nearly, revolutions of lying shaft.
480

239
240—nearly.

If a drum 18 inches diameter, be fixed on a shaft making 96,923 revolutions per minute; what number of revolutions will the main cylinder of carding engine make, with a pulley fixed on cylinder end 15 inches diameter, and driven by a strap from the drum 18 inches diameter?

96,923 revols. per min. of shaft.
18 in. diam. of drum on do.

775384
96923

Diam. of pul. on cylinder end, inches. 15)1744,614(116,3 revols. of main cylinder per min.
15

24
15

94
90

46
45

1

Required the diameter of a pulley to make 116,3 revolutions per minute; the drum fixed on the shaft being 18 inches diameter,

making 96,923 revolutions per minute?

96,923 revolutions of shaft per minute.
18 inches diameter of drum.

775384
96923

Revols. required 116,3)1744,614(15 inches diam. of pulley required
1163

5816
5815

1

N. B.—The speed of any piece of machinery may be ascertained, according to the foregoing Rules and Examples.

The speed of a counter shaft is required, the following particulars being given:—
First shaft 96 revolutions per minute.—Drum on said shaft 18 inches diameter.—Drum on second shaft 14 inches diameter.—Drum on the second shaft for driving the third shaft 10 inches diameter.—Drum on the third shaft 9 inches diameter.

Drum on 2nd. shaft 14 inches diameter.
Do. 3rd. do. 9 do. do.

126 divisor.

96 revolutions of shaft per minute.
18 inches diameter of drum on do.

768
96

1728
10 inches diameter of drum on 2nd. shaft.

126)17280(137,14 revols. of counter shaft per min.
126

468
378

900
882

180

180
126

540
504

36

ON MIXING COTTON.

On account of the great variations (even of the same kinds) of cotton, it will be found the best to mix a number of bales or bags together; arranging them properly in the place appropriated for the purpose, which done, proceed to throw abroad one bale or bag, covering as much surface as convenience will allow, according to the number intended to be mixed, and proceed till the last is thrown on your stock, treading it well down as you proceed. When done, and wanted for use, rake it down with a rake, similar to a garden rake, regularly from the top to the bottom, which will be found not only to mix it regularly, but will open the cotton considerably, which is very essential, prior to being put through the first preparatory piece of machinery.

In all cases it will be well to mix as great a number of bales or bags of cotton as can be done conveniently; because, whenever there is a fresh mixing of cottons, it is almost sure to require an alteration in some of the machinery, as it seldom happens that the mixing will produce the same weight of roving or yarn.

ON MACHINERY.

In treating on machinery the rules and examples will be laid down in the most easy, plain, and simple manner, so that persons possessing only a knowledge of the fundamental rules of arithmetic, will be able to comprehend them; and by following the rules, examples, and illustrations laid down, will be able to acquire every necessary qualification that will be requisite, (so far as regards calculations) for persons filling up the important situations, as managers, or overlookers, in any, or every department of the cotton manufacture.

In the following calculations, all vulgar fractions that can possibly be avoided are omitted, and decimal fractions used where they occur; a knowledge of which may be easily obtained from almost any Arithmetic.

WILLOW.

Willows are generally in use for opening the cotton and taking out the heavy dirt. They are of various constructions. The one of which the following are the particulars, is of the most recent construction.

A square cylinder measuring 30 inches, from angle to angle.
4 strips, (i. e.) one at each corner, 4 inches by 3½ inches.
4 strips on the top corner, 4 inches by 3½ inches.
9 teeth or pins in each strip on the cylinder, at a regular distance from each other.
7 teeth in each strip on the top, or cover, and set opposite the centre of the spaces.
Distance of teeth 4 inches, length of teeth 4 inches.
Diameter of teeth at bottom 1 inch, regularly tapering to ⅜ inch.
Circular iron grate bars, or rods, half inch distant from each other.

The time for the cotton remaining in the willow is governed by wheels, one of which has a pin fixed in it, and every time it revolves, works upon a spring connected with a lever, which opens the lid and discharges the cotton.

N. B.—It is customary with some to take off the wheels, having the lid continually down, consequently, the cotton thrown in will only revolve once or twice, before being discharged.

This system is adopted, by the probability of the cotton being strung, by being too long detained in the machine.

If the shaft for driving a willow makes 158,84 revolutions per minute, with a drum fixed on it 26 inches diameter, and the pulley on the end of willow cylinder be 12 inches diameter; what number of revolutions will the cylinder make per minute?

158,84 revolutions of shaft per min.
26 inches diam. of drum on shaft.

95304
31768

Diameter of pulley on willow cylinder end, } inches. 12)4129,84

344,15333 revois. per min. of cyl.

BLOWING MACHINE WITH TWO BEATERS.

Shaft for driving blowing machine 315,374 revols. per min. Drum on said shaft 45,5 inches diameter. Pulley on beater ends 10 inches.

315,374 revolutions of shaft per min.
45,5 inches diam. of drum on shaft.

1576870
1576870
1261496

Diam. of pulley on beaters, 10 inches.) 14349,5170

1434,9517 revols. of beater at blowing machine per min.

If a pulley 4,75 inches diameter be fixed on the end of a beater, making 1535 revolutions per minute; what number of revolutions per minute will a shaft make, with a pulley fixed on it 31 inches diameter, and driven by a strap from the pulley 4,75 inches diameter?

1435 revolutions of beater per minute.
4,75 in. diam. of pul. on beater end.

7175
10045
5740

Diameter of pulley on under shaft, inches. 31)6816,25(219,879 revols. of shaft per min.
62

61
31

306
279

272
248

245
217

280
279

1

If a wheel with 14 teeth be fixed on the end of the shaft at blowing machine, making 219,879 revolutions per minute; what number of revolutions per minute will a shaft make with a wheel 88 teeth, fixed on the end, and driven by a wheel 14 teeth?

219,879 revolutions of given shaft per min.
14 teeth wheel on end of do.

879516
219879

teeth.
Whl. on geering shaft 88)3078,306(34,98 revols. of geering shaft per minute.
264

438
352

863
792

710
704

6

If a wheel with 35 teeth be fixed on the other end of geering shaft, working into wheel 35 teeth on bottom of bevil shaft, and a wheel 35 teeth on the top of bevil shaft, be working into a wheel 60 teeth on the end of creeper, or delivering roller; what revolutions will the creeper, or delivering roller make per minute?

34,98 revols. of geering shaft per min.
35 teeth wheel on top of bevil shaft.

17490
10494

Wheel on end of creeper roller, } teeth.
60)1224,30

20,405 revols. of creeper, or delivering roller per minute.

N. B.—The 35 teeth wheels on end of geering shaft, and bottom of bevil shaft are omitted, on account of their being the same as carrying, or connecting wheels only.

If a wheel 18 teeth be fixed on creeper, or delivering roller, making 20,405 revolutions per minute, working into a wheel on stud with 40 teeth, which works into a wheel 64 teeth on another stud, which works into wheel 96 teeth on the front, or second wire cylinder end; what number of revolutions will the cylinder make per minute?

N. B.—All the intermediate wheels between the creeper roller and wheel on wire cylinder end, are omitted in the operation, being only carrying, or connecting wheels, which, if made use of, must be considered as both driving and driven wheels.

20,405 revols. of creeper roller per min.
18 teeth wheel on end of do.

163240
20405

teeth.

Wheel on wire cyl. end, 96)367,290(3,826 nearly revols. of 2nd. wire cylinder per minute.
288

792
768

249
192

570
576—nearly.

If a wheel with 52 teeth be fixed on the end of geering shaft, making 34,98 revolutions per minute, working into a wheel 52 teeth; (a shaft which is the length of the machine, for propelling the shafts of the feed rollers); on the lying shaft is a wheel with 50 teeth working into a wheel on the bottom of upright shaft 40 teeth, and a wheel with 89 teeth on the top of upright shaft, working into a wheel 82 teeth on the end of feed rollers; what number of revolutions will the feed rollers make?

(CONTINUED.)

N. B.—The first two wheels 52 teeth each, are omitted, being only carrying or connecting wheels.

When there are more than one driving and driven wheels, multiply the revolutions per minute of your given shaft, by the driving wheels respectively for a dividend, and your driven wheels (only) together for a divisor, and the quotient will be the revolutions per minute required.

34,98 revolutions of given shaft per minute.
50 teeth wheel first driver.

1749,00
39 teeth wheel top of upright shaft working into wheel 82 teeth on roller end.

15741
5247

68211 dividend.

40 teeth wheel on bottom of upright shaft.
82 teeth wheel on feed roller end.

3280 divisor.

3280)68211(20,796 revols per min. of 2nd. feed roller.
6560

26110
22960

31500
29520

19800
19680

120

If a wheel with 12 teeth be fixed on the end of the feed rollers, making 20,793 revolutions per minute, works into a stud wheel 26 teeth, which works into wheel 26 teeth on first creeper roller end; what number of revolutions per minute will the first creeper roller make?

20,793 revolutions of 2nd. feed roller per min.
12 teeth in wheel on do.

Wheel on 1st. creeper, } teeth.
26)249,516(9,6 revols. of 1st. creeper rol. per min.
234

155
156—nearly.

If a wheel with 16 teeth be fixed on the first creeper roller, making 9,6 revolutions per minute, works into a stud wheel 96 teeth, (carrier,) which works into wheel 96 teeth on first wire cylinder end; what number of revolutions will the first wire cylinder make per minute?

9,6 revols. of first creeper roller per min.
16 teeth wheel fixed on do.

576
96

Wheel on 1st. wire cyl. 96 teeth.) 153,6 (1,6 revols. of 1st. wire cyl. per min.
96

576
576

If a wheel with 40 teeth be fixed on a lying shaft, making 34,98 revolutions per minute, works into a wheel 50 teeth on the bottom of an upright shaft, and a wheel 40 teeth fixed on the top of upright shaft works into wheel 82 teeth on end of feed rollers; what number of revolutions will the first feed roller make per minute?

Wheel on bottom of upright shaft 50 teeth.
Wheel on 1st feed roller end 82 teeth.

4100 divisor.

34,98 revolutions of lying shaft per minute.
40 teeth wheel on do.

1399,20
40 teeth wheel on top of upright shaft.

4100) 55968,00 (13,65 revolutions of 1st. feed roller per min.
41

149
123

266
246

208
205

3

If a wheel with 12 teeth fixed on the end of feed rollers, making 13,65 revolutions per minute, works into a wheel 26 teeth on feed cloth roller; what number of revolutions per minute will the feed cloth roller make?

13,65 revols of feed rol. per min.
12 teeth wheel on end of do.

teeth.———
Whl. on end of feed cloth rol. 26)163,80(6,3 revols. of feed cloth
156 roller per minute.

78
78

If the feed cloth roller be 3 inches diameter, making 6,3 revolutions per minute; how many inches will the feed cloth traverse?

6,3 revols. of feed cloth roller per min.
3 inches diameter of feed cloth roller.

18,9
3,1416 circumference when the diam. is 1.

1134
189
756
189
567

59,37624 inches feed cloth traverses per min.

If the first creeper roller be 3,5 inches diameter, making 9,6 revolutions per minute; how many inches will it traverse?

3,1416 circumference when the diameter is 1.
3,5 diameter of creeper roller.

157080
94248

10,99560 inches circumference of creeper roller.
9,6

6597360
9896040

105,557760 inches first creeper roller traverses per min.

If the second feed roller be 1,5 inch diameter, making 20,793 revolutions per minute; how many inches will it traverse?

3,1416 circumference when the diameter is 1.
1,5 diameter of feed roller.

157080
31416

4,71240 inches circumference of feed roller.
20,793

141372
424116
329868
942480

97,9849332, or nearly 98 inches feed roller traverses per minute.

If the second creeper, or delivering roller be 3,5 inches diameter, making 20,405 revolutions per minute; how many inches will it traverse?

3,1416 circumference when the diameter is 1.
3,5 inches diameter of second creeper, or delivering roller.

157080
94248

10,99560 inches circumference of second creeper or delivering rollers.
20,405

549780
4398240
2199120

224,3652180 inches creeper, or delivering roller traverses per minute.

N. B.—The draught of any piece of machinery may be ascertained by dividing the distances traversed, into each other, as will appear in a future part of this work.

DIMENSIONS &c. OF A DOUBLE BLOWING MACHINE.

Beaters make 1435 revolutions per minute.
Feed cloth roller makes 6,3 revolutions per minute.
First feed roller makes 13,65 revolutions per minute.
First creeper roller makes 9,6 revolutions per minute.
First wire cylinder makes 1,6 revolutions per minute.
Second feed roller makes 20,8 revolutions per minute.
Second creeper, or delivering roller, in the front of machine, makes 20,405 revolutions per minute.
Second wire cylinder makes 4,888 revolutions per minute.
Distance of grate bars from each other $\frac{1}{4}$ an inch,
Distance of grate bars from beaters $1\frac{1}{4}$ to $\frac{1}{2}$ an inch.
Diameter of beaters 18 inches.
Diameter of feed cloth rollers 3 inches.
Diameter of iron feed rollers $1\frac{1}{2}$ inch.
Diameter of plain iron rollers 2 inches.
Diameter of creeper rollers $3\frac{1}{2}$ inches.
Diameter of wire cylinder 22 inches.

N. B.—The rollers not named a second time are of the same dimensions as those above.

Feed cloth roller traverses 59,37624 inches per minute.
First creeper roller traverses 105,55776 inches per minute.
Second feed roller traverses 98 inches per minute—nearly.
Second creeper, or delivering roller traverses 224,365218 inches per minute.

N. B.—The above particulars will materially differ from some blowing machines, but the particulars of any machine may be found, by following the examples and illustrations laid down.

LAP MACHINE.

It has become very general of late years to have two lap machines, in place of a blowing machine and a lap machine, and where it is the case, two or three laps from the first machine are put up at the second, which has a great tendency to equalize the lap, and produce more even carding; however, the following are the particulars where *only* a certain weight is fed on a given length of the feed cloth without any doubling, but there will be little difference in the machine, further than the difference at the feeding parts, or in the draughts of the machine.

If the shaft for driving lap machine makes 315,3747 revolutions per minute, the drum on said shaft 40,5 inches diameter, and the pulley on the beater end 11,25 inches diameter; how many revolutions will the beater make per minute?

315,3747 revolutions of shaft per minute.
40,5

15768735
126149880

inches.

Diam. of pulley 11,25)12772,67535(1135,3489 revols. of beater per minute.
1125

1522
1125

3976
3375

6017
5625

3925
3375

5503
4500

10035
9000

10350
10125

225

If a pulley 4,75 inches diameter, be fixed on the end of a beater making 1135,3489 revolutions per minute; what revolutions per minute will a shaft make with a pulley fixed on it 31,5 inches diameter, and driven by a strap from pulley 4,75 inches diameter?

1135,3489 revolutions of beater per minute.
4,75 in. diam. of pulley on beater end.

56767445
79474423
45413956

Diam. of pul. on shaft, } inches.

31,5)5392,907275(171,2 revols. of shaft working geering per minute.
315
2242
2205
379
315
640
630
10

If a wheel 14 teeth, be fixed on shaft making 171,2 revolutions per minute, and works into a carrying wheel with 30 teeth, which drives a wheel 88 teeth on geering shaft; what number of revolutions per minute will the geering shaft make?

171,2 revols. of shaft per min. working geering.
14 teeth wheel fixed on said shaft.

6848
1712

Wheel on geering shaft } tth.

88)2396,8(27,236 revols. per min. of geering shaft.
176
636
616
208
176
320
320
264
560
528
32

If a wheel with 16 teeth, be fixed on a shaft making 27,236 revolutions per minute, works into a wheel 88 teeth on the end of lap roller; how many revolutions will the lap roller make per minute?

27,236 revolutions of shaft per minute.
16 teeth wheel on said shaft.

163416
27236

teeth.
Wheel on lap roller, 88)435,776(4,952 revols. of lap rol. per min.
352

837
792

457
440

176
176

N. B—There is a wheel of 30 *teeth fixed on the first lap roller, which works into a wheel* 20 *teeth on stud, which drives a wheel* 30 *teeth on the second lap roller, consequently it will be the same speed as the first.*

If a wheel 22 teeth fixed on geering shaft, make 27,236 revolutions per minute, works into a wheel 88 teeth on front iron roller; what number of revolutions will the front iron roller make per minute?

27,236 revols. of geering shaft per min.
22 teeth wheel on do.

54472
54472

teeth.
Whl. on front iron rol.,88)599,192(6,809 revolutions of front iron roller per minute.
528

711
704

792
792

If a wheel 20 teeth fixed on the front iron roller, making 6,809 revolutions per minute, works into a wheel 19 teeth on stud, which works into wheel 19 teeth on creeper roller; what number of revolutions will the creeper roller make per minute?

6,809 revolutions of iron rollers per min.
20 teeth wheel fixed on do.

teeth.
Wheel on creeper roller 19)136,180(7,167 revol. of creep. rol. per min.
133

31
19

128
114

140
133

7

If a wheel 18 teeth fixed on the end of creeper roller, making 7,167 revolutions per minute, works into a wheel with 64 teeth on stud, which works into a wheel 96 teeth on wire cylinder end; what number of revolutions will the wire cylinder make per minute?

7,167 revolutions of creeper roller per min.
18 teeth wheel fixed on do.

57336
7167

teeth.
Wheel on wire cyl., 96)129,006(1,3438 revols. of wire cyl. per min.
96

330
288

420
384

366
288

780
768

12

If a wheel with 36 teeth, fixed on the end of the creeper roller, making 7,167 revolutions per minute, works into a wheel with 36 teeth on feed roller shaft, and on the other end of feed roller shaft is a wheel with 46 teeth, which works into a wheel with 30 teeth on feed roller end; what number of revolutions will the feed rollers make per minute?

7,167 revols. of creeper roller per min.
46 teeth on end of feed roller shaft.

43002
28668

Whl. on feed rol. 30 tth.)329682

10,9894 nearly 11 revols. of feed rollers per minute.

N. B.—The two 36 teeth wheels are not noticed, the one being a driver, and the other driven.

If a wheel with 12 teeth fixed on feed rollers, making 10,9894 revolutions per minute, works into a stud wheel 26 teeth, working into wheel 26 teeth on feed cloth roller end; what number of revolutions will the feed cloth roller make per minute?

10,9894 revols. of feed rollers per min.
12 teeth wheel on do.

teeth.
Whl. on feed cloth rol. 26)131,8728(5,072 revols. of feed cloth roller per minute.
130

187
182

52
52

What number of inches will the feed cloth traverse per minute, if the diameter of feed cloth roller be 3 inches, making 5,072 revolutions per minute?

N. B.—To find the circumference of wheels, drums, pulleys, rollers, &c., multiply the diameters by 3,1416, *which is equal to the circumference when the diameter is* 1.

5,072 revols. of feed cloth rol. per min.
3 inches diameter of do.

15,216
3,1416

91296
15216
60864
15216
45648

47,8025856 being rather more than 47¾ inches, feed cloth traverses per min.

If the feed rollers of lap machine be 1½ inch diameter, making 10,9894 revolutions per minute; what number of inches will they traverse per minute?

10,9894 revolutions of feed rollers per min.
1,5 inch diameter of do.

549470
109894

16,48410
3,1416 circumference when the diam. is 1.

989046
164841
659364
164841
494523

51,78644856 inches feed rols. traverse per min.

What is the draught between feed cloth and feed rollers, from the two preceding examples?

Inches feed cloth traverses. Inches feed rols. traverse.

47,8025856)51,78644856(1,083 inch draught between feed cloth & feed rol.
478025856

8988862960
3824206848

1596561120
1434077568

162483552

If the creeper roller at lap machine be $3\frac{1}{2}$ inches diameter, making 7,167 revolutions per minute, what number of inches will it traverse in a minute?

7,167 revolutions of creeper roller per minute.
3,5 inches diameter of do.

35835
21501

25,0845
3,1416 equal to circumference when diam. is 1.

1505070
250845
1003380
250845
752535

78,80546520 inches creeper traverses per minute.

Required the draught between the feed rollers and the creeper; the feed rollers traversing 51,78644856 inches per minute, and the creeper the same as in the preceding example? *(See next page.)*

Inches feed rollers traverse. Inches the creeper traverses.

51,78644856)78,80546520(1,5217 draught between feed roller and creeper rollers.

5178644856

27019016640
25893224280

11257923600
10357289712

9006338880
5178644856

38276940240
36250513992

2026426248

If the iron roller in front of lap machine be $3\frac{1}{16}$ inches diameter, making 6,809 revolutions per minute; what number of inches will it traverse per minute?

16 { 4)15,00 / 4)3,75 } ,9375 inches. 6,809 revols. of iron rol. per min.

therefore $= 3\frac{1}{16}$ 3,9375 inches diameter on do.

34045
47663
20427
61281
20427

26,8104375
3,1416 circum. when diam. is 1.

1608626250
268104375
1072417500
268104375
804313125

84,22767045000 inches, or $84\frac{1}{4}$ inches nearly, iron roller, front of lap machine traverses per minute.

Required the draught between creeper roller and iron roller, from the preceding examples?

Inches. Inches.
78,8)84,22767(1,068 draught between creeper rol. and
788 iron rol. at lap machine.

5427
4728

6996
6304

6927

6927
6304

623

N. B.—It is not practically necessary or requisite, to carry any examples to more than 3 or 4 decimal figures, however they may occur in multiplying; but they may be used if thought proper in dividing.

If the lap roller be 6½ inches diameter, making 4,952 revolutions per minute; how many inches will it traverse per minute?

4,952 revolutions of lap roller per minute.
6,5 inches diameter of do.

24760
29712

32,1880
3,1416

193128
32188
128752
32188
96564

101,1218208 inches lap roller traverses per minute.

Required the draught between the iron roller and the lap roller, from the preceding examples.

Inches. Inches lap roller traverses per minute.
84,2276)101,1218208(1,2 draught between iron rol. and lap rol.
842276

1689422
1684552

4870

The total draught at the lap machine may be ascertained by multiplying the different draughts into each other.

OR,

By multiplying all the driving wheels together, beginning at the wheels driving the lap roller, and taking them respectively, (except the driving and driven wheels, which, being of the same number of teeth, are omitted,) to the feed cloth roller, the product of which must be multiplied by the diameter of the feed cloth roller, for a divisor, and all the driven wheels multiplied in the same manner, the products of which must be multiplied by the diameter of the lap roller for a dividend, and the quotient will be the draught, as in the following examples.

Draught between feed cloth and feed rollers 1,08.
Draught between feed roller and creeper roller 1,52.
Draught between creeper roller and iron roller 1,068.
Draught between iron roller and lap roller 1,2.

1,08 draught between feed cloth and feed rollers.
1,52 draught between feed roller and creeper roller.

216
540
108

1,6416
1,0688 draught between creeper roller and iron roller.

131328
131328
98496
164160

1,75454208
1,2 draught between iron roller and lap roller.

350908416
175454208

2,105450496 total draught at lap machine.

THE SAME EXAMPLE AS LAST—BY WHEELS.

The first driven wheel on lap roller is 88 teeth, working into a wheel 16 teeth on the end of geering shaft; then on the other end of geering shaft there is a wheel with 22 teeth, working into a wheel with 88 teeth on iron roller; on the other end of iron roller a wheel with 20 teeth works into a wheel with 20 teeth on the top roller, which works into a wheel with 20 teeth on a stud, which works into a wheel with 19 teeth on the creeper roller end; on the other end of creeper roller there is a wheel with 36 teeth, working into a wheel with 36 teeth on the end of the feed roller shaft, on the other end of the feed roller shaft there is a wheel with 46 teeth working into a wheel with 30 teeth on the end of the feed roller; on the other end of the feed roller there is a wheel with 12 teeth working into a wheel with 26 teeth on a stud, which works into a wheel with 26 teeth on the end of the feed cloth roller; the lap roller is 6½ inches diameter, and the feed cloth roller 3 inches diameter; what is the draught at lap machine?

DRIVING WHEELS.

88 teeth wheel on lap roller.
22 teeth wheel on geering shaft.

176
176

1936
20 teeth wheel on iron roller

38720
46 teeth wheel on feed shaft.

232320
154880

1781120
12 teeth wheel on feed roller.

21373440
3 inches diameter of feed cloth roller.

64120320 divisor.

N. B.—The carrying, or connecting wheels, and driving and driven wheels working together, where they contain the same number of teeth, are omitted, as will be found in the preceding and following examples.

(Continued.)

DRIVEN WHEELS.

16 teeth wheel on geering shaft.
88 teeth wheel on iron roller.

128
128

1408
19 teeth wheel on creeper roller.

12672
1408

26752
30 teeth wheel on feed roller.

802560
26 teeth wheel on feed cloth roller.

4815360
1605120

20866560
6,5 diameter of lap roller.

104332800
125199360

135632640,0 dividend.

Divisor. Dividend.
64120320)135632640(2,115 draught at lap machine.
128240640

73920000
64120320

97996800
64120320

338764800
320601600

18163200

N. B.—The small difference between the last two examples is in the method of working, arising from the decimal parts; however, working draughts by wheels as in the last example, is the surest way where great accuracy (which is indispensible,) is required.

The following are the particulars of a lap machine, where there are no doublings.

Beater makes 1135,348 revolutions per minute.
Feed cloth roller makes 5,072 revolutions per minute.
Feed rollers make 10,9894 revolutions per minute.
Creeper roller makes 7,167 revolutions per minute.
Iron rollers make 6,809 revolutions per minute.
Lap rollers make 4,952 revolutions per minute.

Distance of grate bars from each other $\frac{1}{2}$ an inch.
Distance of grate from beater 1 inch.
Diameter of beater 18 inches.
Diameter of feed cloth roller 3 inches.
Diameter of feed rollers $1\frac{1}{2}$ inch.
Diameter of creeper roller $3\frac{1}{2}$ inches.
Diameter of iron rollers $3\frac{5}{16}$ inches.
Diameter of lap rollers $6\frac{1}{2}$ inches.

Feed cloth roller traverses 47,7025856 inches per minute.
Feed rollers traverse 51,78644856 inches per minute.
Creeper rollers traverse 78,8054652 inches per minute.
Iron rollers traverse 84,2276704 inches per minute.
Lap rollers traverse 101,12182808 inches per minute.

Draught between feed cloth and feed rollers 1,08.
Draught between feed rollers and creeper 1,52.
Draught between creeper and iron rollers 1,0688.
Draught between iron rollers and lap rollers 1,2.

Total draught at lap machine 2,115.

CARDING ENGINE.

CARDING engines are of various constructions, but the construction of machinery will make no difference in the system of calculation, as all the various speeds &c. are ascertained from that part which first receives motion, which is without exception the main cylinder.

The opinions of persons connected with cotton carding are diversified; however, all nearly agree in the most essential points, i. e. in having the cards true and sharpened to a diamond point, and whether worked with *rollers, rollers and clearers, rollers clearers* and part *flats*, or *all flats*; to have the wire set near as possible, so as not to touch each other, the first 3 or 4 flats set rather more on the heel, or back of card, for the purpose of detaining the heavy dirt. Some kinds of cotton require considerably more carding than others; however it may be observed, that the less cotton is carded the better, so that the dirt is taken out, and the fibres laid straight, after which, the cotton by being continued in the cards is *only weakened*, consequently the yarns will be weakened in proportion, which must appear reasonable to any practical person.

If a shaft make 95,3057 revolutions per minute, with a drum fixed on it 16 inches diameter; what number of revolutions per minute will the main cylinder of a carding engine make, with a pulley fixed on it 14 inches diameter, and driven with a strap from the drum 16 inches diameter?

95,3057 revolutions of shaft per minute.
16 inches diameter of drum.

5718342
953057

Diam. of pulley, 14 in.)1524,8912(109 revols. of main cylinder
14 (nearly) per minute.

124
126—nearly.

If the main cylinder of a carding engine makes 108,92 revolutions per minute, with a wheel on its axis 22 teeth, working into a wheel 140 teeth on stud; on same stud there is a wheel 32 teeth, working into wheel 130 teeth on a stud, which drives wheel 130 teeth on end of doffer cylinder; what number of revolutions will the main cylinder make for the doffer cylinder one, and what number of revolutions will the doffer cylinder make per minute?

140 teeth wheel on stud.
130 teeth wheel on doffer cylinder end.

4200
140

18200 divisor.

108,92 revolutions of main cylinder per min.
22 teeth wheel on axis of cylinder.

21784
21784

2396,24
32 teeth wheel on stud.

479248
718872

18200)76679,68(4,213 revols. of dof. cyl. per min.
72800

38796
36400

23968
18200

57680
54600

3080

The revolutions of the main cylinder for the doffer cylinder one, will be found by dividing the revolutions of the main cylinder by the revolutions of the doffer cylinder.

Revols. of dof. cyl. 4,213)108.92(25,85 revols. of main cyl. for dof. 1

8426

24660
21065

35950
33704

22460
21065

1395

The number of revolutions the main cylinder makes for the doffer cylinder 1, will be found by multiplying the driving wheels together for a divisor, and the driven wheels together for a dividend, as in the following example.

DRIVING WHEELS.

Wheel on cylinder end 22 teeth.
Wheel on stud 32 teeth.

44
66

704 divisor.

DRIVEN WHEELS.

Wheel on stud 140 teeth.
Wheel on doffer cyl. 130 teeth.

4200
140

18200 dividend.

(Carried to next page.)

704)18200(25,85 revols. main cyl. makes for dof cyl. 1
1408

4120
3520

6000
5632

3680
3520

160

What will the main cylinder of a carding engine traverse per minute, if it makes 108,92 revolutions, and its diameter be 37 inches?

108,92 revols. of main cyl. per minute.
37 inches diam. of main cylinder.

76244
32676

4030,04
3,1416 circum. when the diam. is 1.

2418024
403004
1612016
403004
1209012

inches.
1 foot=12)12660,773664 inches main cyl. trav. per min.
feet.
1 yard=3) 1055,064472 feet main cyl. trav. per min.

351,688157333 yards main cyl. trav. do.

What surface will the doffer cylinder of a carding engine traverse per minute, if it makes 4,213 revolutions, and is 18 inches diameter?

4,213 revolutions of doffer cylinder per minute.
18 inches diameter of do.

33704
4213

75,834
3,1416 circumference when the diameter is 1.

455004
75834
303336
75834
227502

inches.
1 ft.=12)238,2400944 inches doffer cylinder traverses per minute.
feet.
1 yd.=3)19,8533412 feet doffer cylinder traverses per minute.

6,6177804 yards doffer cylinder traverses per minute.

How many feet of fillet, 2 inches wide, will it require to cover a doffer cylinder 18 inches diameter, and 36 inches wide?

3,1416 circumference when the diameter is 1.
18 inches diameter of doffer cylinder.

251328
31416

56,5488
36 inches width of doffer cylinder.

3392928
1696464

inches.
Width of fillet, 2)2035,7568 inches area of doffer cylinder.
inches.
1 foot=12)1017,8784 inches of fillet required for cylinder.

84,8232 or nearly 85 feet of fillet required for do.

N. B.—By taking the taper off one end of the fillet, and putting it to the other end, nearly 5 feet of fillet will be saved; consequently 80 feet of the above fillet will be sufficient to cover a cylinder of the above dimensions.

Whatever the width of the fillet is, divide the number of inches in the area of the cylinder, by the width of the fillet, and the quotient will be the number of inches required to cover the cylinder; then deduct the inches in the circumference of the cylinder from the quotient, and the remainder will be the net length of fillet required.

N. B.—The circumference of the cylinder must only be deducted when the taper end is cut off the beginning of the fillet, and is intended to be put on at the other end.

How many feet of 1½ inch fillet will be required to cover a cylinder 18 inches diameter, and 36 inches wide?

3,1416 equal to circum. when diam is 1.
18 inches diameter of cylinder.

251328
31416

56,5488 circumference of cylinder.
36 inches width of cylinder.

3392928
1696464

2035,7568
Deduct inches. 56,5488 circumference of cylinder.

Width of fillet, 1,5)1979,2080(1319,472 inches of fillet required to cover the cylinder.
15

47
45

29
15

142
135

70
60

108
105

30
30

Or,

1 ft. = 12in.)1319,472 inches.

1 yd. = 3 feet)109,956 or nearly 110ft.

36,652 yds. nearly 36¾ yards.

Required the speed of the feed rollers of a carding engine, from the following particulars?

Revolutions of doffer cylinder per minute 4,213.

Wheel on doffer cylinder end, driving feed roller shaft 28 teeth.

Wheel on feed roller shaft (doffer end) 28 teeth.

Wheel on feed roller shaft, driving feed rollers 13 teeth.

Wheel on feed roller end 128 teeth.

N. B.—The wheels 28 teeth on the doffer cylinder end, and feed roller shaft, may be omitted, the one being a driving and the other a driven wheel.

4,213 revols. of doffer cyl. per minute.
13 teeth wheel on feed roller shaft.

12639
4213

54,769 teeth.

Whl. on feed rol. shaft, 128)54,769),4278 revols. of feed rols. per min.
512

356
256

1009
896

1130

1130
1024

106

If the diameter of the feed rollers be $1\frac{1}{2}$ inches, making ,4278 revolutions per minute; how many inches will the feed rollers traverse?

,4278 revolutions of feed rollers per min.
1,5 inches diameter of do.

21390
4278

,64170
3,1416 circumference when diameter is 1.

385020
64170
256680
64170
192510

2,015964720 or $2_{6}^{1}{}_{6}$ inches nearly feed rollers traverse per minute.

What length of lap will be required to supply a carding engine 1 day, allowing it to work 10 hours, (2 hours being allowed for stripping, grinding &c.,) if the feed rollers traverse 2,01596472 inches per minute?

2,01596472 inches feed rols. traverse per minute.
60 minutes = 1 hour.

120,95788320
10 hours = 1 day.

1209,57883200 inches, or nearly 100 feet 10 inches per day.

Required the weight of cotton to supply a carding engine 1 day, the feed rollers of which traverse over a surface equal to 1209,578832 inches, there being 24 ounces fed on 30 inches of feed cloth at lap machine, and the draught at lap machine being 2,115.

oz. cotton.
Draught at lap machine, 2,115)24,000(11,347517 oz. weight of 30 inches of lap.
2115

2850
2115

7350
6345

10050
8460

15900
14805

10950
10575

3750
2115

16350
14805

1545

(Carried to next page.)

Feed cloth at lap mach. 30 in.)1209,578832 inches feed rols. trav.

40,3192944 number of feeds.
11,347517 oz. weight of 30 inches of lap.

2822350608
403192944
2015964720
2822350608
1612771776
1209578832
403192944
403192944

4)457,5238786320048 nearly 457½ oz. or 28 6/10 lbs. nearly.

4)114,3809696580012

28,5952424145003 lbs.

OR,

Multiply the number of inches (say 30,) on which 24 ounces weight of cotton is fed on the feed cloth at lap machine, by the draught at lap machine, (draught 2,115,) and that sum by the number of ounces in 1 lb. for a divisor, and the number of inches the feed rollers traverse in one day, or 10 hours, by the number of ounces fed on 30 inches on feed cloth at lap machine, for a dividend, and the quotient will be the pounds weight required to supply the engine.

2,115 draught at the lap machine.
30 inches length fed on feed roller.

63,450
16 ounces make one pound.

380700
63450

1015,200 divisor.

(Carried to next page.)

1209.578832 inches of lap required per day.
24 oz. weight fed on 30 inches of feed cloth at lap machine.

4838315328
2419157664

1015,2)29029,891968(28,5952lbs. per day.
20304 16 ounces = 1lb.

87258 35712
81216 5952

60429 9,5232 oz.
50760 4 qrs. = 1 oz.

96691 2,0928 qrs.
91368

53239
50760

24796
20304

4492

N. B.—The weight of cotton required to supply a preparation, must be according to the number of carding engines. The weight consumed by one carding engine, multiplied by the number of carding engines in the preparation, will give the weight of cotton required.

What number of revolutions will the doffer cylinder of a carding engine make, for the feed rollers 1, if the wheels on the doffer cylinder end and feed roller shaft be the same; and on the other end of feed roller shaft, a wheel with 13 teeth, working into a wheel 128 teeth on feed roller end?

Wheel on feed shaft, 13 teeth)128(9,846 revols. of doffer cyl. for feed rollers 1.
117

110
104

60 80
52 78

80 2

The speed of the lap rollers at carding engine is required from the following particulars?

Revolutions of feed rollers per minute, ,4278; wheel on feed roller end 17 teeth, working into a wheel 84 teeth on stud, which works into a wheel 46 teeth on lap roller.

,4278 revolutions of feed rollers.
17 teeth wheel on do.

29946
4278

Wheel on lap roller, 46 teeth)7,2726(.1581 revols. of lap rollers per minute.
46

267
230

372
368

46
46

If the lap roller makes ,1581 revolutions per minute, and be $3\frac{3}{4}$ inches diameter; what number of inches will it traverse?

,1581 x 3,75 = ,592875 x 3,1416 = 1,8625761, or rather more than $1,\frac{17}{20}$ inches, lap roller traverses per minute.

If the feed rollers traverse 2,01596472 inches per minute, and the lap rollers 1,862576 inches; what draught is there between the feed rollers and lap rollers?

1,862576 in.)2,01596472(1,082 draught between lap rollers, and feed rollers.
1862576

15338872
14900608

4382640
3725152

657488

(Continued.)

OR,

The draught between the feed rollers and lap rollers is required from the following particulars ?

Wheel on end of feed rollers 17 teeth, working into stud wheel 84 teeth, which works into wheel 46 teeth on the end of lap rollers ?

Diameter of feed rollers, $1\frac{1}{2}$ inches.
Diameter of lap rollers, $3\frac{3}{4}$ inches.

3,75 inches diameter of lap rollers.
17 teeth in wheel on feed rollers.

2625
375

63,75 divisor.

1,5 inches diameter of feed rollers.
46 teeth wheel on lap rollers.

90
60

63,75)69,00(1,0823 draught between lap rollers and feed rollers.
6375

52500
51000

15000
12750

22500
19125

3375

Required the draught between the feed rollers and lap rollers, from the following particulars?

Revolution of feed rollers per minute ,4278.
Revolution of lap rollers per minute ,1581.
Diameter of feed rollers, 1,5 inches.
Diameter of lap rollers, 3,75 inches.

,1581 revolution of lap rollers per minute.
3,75 inches diameter of do.

7905
11067
4743

5,92875 divisor.

,4278 revolution of feed rollers per minute.
1,5 inches diameter of do.

21390
4278

5,92875)6,41700(1,082 draught between feed rollers and lap rollers.
592875

4882500
4743000

1395000
1185750

209250

What weight of cotton will be required to supply a carding engine 1 day, or 10 hours, according to the following particulars?
Weight fed on 30 inches of feed cloth at lap machine, 24 ounces.
Draught at lap machine 2,115.
Lap roller traverses 1,862576 inches per minute.

60 minutes 1 hour.

111,754560
10 hours=1 day.

1 foot=12 in.)1117,545600 inches per day, lap roller traverses.

93,1288 feet per day do. *Continued.)*

93,1288 feet of lap required per day.
24 oz. weight fed on 2½ feet, or 30 inches of feed cloth at lap machine.

3725152
1862576

2235,0912 dividend.

2,115 draught at lap machine.
2,5 feet, or 30 inches feed cloth at lap mac.

10575
4230

5,2875
16 ounces = 1lb.

317250
52875

84,6000 divisor

Divisor. Dividend. lbs. oz.
84,6)2235,0912(26..6½ weight of cotton required,
1692 to supply a carding engine
1 day, or 10 hours.

5430
5076

354
16 ounces 1lb.

2124
354

84,6)5664(6 oz.
5076

588
4

84,6)2352(2 qrs.
1692

660

N. B.—If there had been no draught between the feed rollers and lap rollers, the weight of cotton required would have been 28lbs. 9½ oz.

The speed of the calender rollers, or delivering balls, is required from the following particulars?

Revolutions of doffer cylinder per minute 4,213.

Wheel on doffer cylinder end 130 teeth, working carrying wheels, which works into wheel 28 teeth on delivering ball shaft.

4,213 revolutions of doffer cylinder per min.
130 teeth wheel on do.

126390
4213

Whl. on cal. ball shaft, } teeth. 28)547,690(19,56 revolutions of delivering balls per minute.

28
267
252
156
140
169
168
1

Required the speed of the calender rollers, or delivering balls, from the following particulars?

Revolutions of main cylinder per minute, 108,92.
Wheel on axis of main cylinder, 22 teeth.
Wheel on stud, 140 teeth.
Wheel on stud, 32 teeth.
Wheel on doffer cylinder end, 130 teeth.—(Working carriers.)
Wheel on delivering ball shaft, 28 teeth.

108,92 revolutions of main cylinder per minute.
22 teeth wheel on axis of do.

21784
21784
2396,24
32 teeth wheel on stud.
479248
718872
76679,68 dividend.

(Continued.)

140 teeth wheel on stud.
28 teeth wheel on delivering ball shaft.

1120
280

3920 divisor.

Divisor. Dividend.
3920)76679,68(19,56 revols. of delivering balls per minute.
3920

37479
35280

21996
19600

23968
23520

448

If the calender rollers, or delivering balls, make 19,56 revolutions per minute, what number of inches, feet, and yards will it traverse, if their diameters be $3\frac{7}{8}$ inches?

3,1416 circumference when the diameter is 1.
3,875 diameter of delivering balls.

157080
219912
251328
94248

12,1737000
19,56 revols. of delivering balls per minute.

730422
608685
1095633
121737

1 foot=12 in.)238,117572 inches, delivering balls traverse per min.

1 yard=3 feet)19,843131 feet, delivering balls traverse per min.

6,614377 yards, delivering balls traverse per min.

Or, 6 yds. 1 ft. $10\frac{1}{8}$ in. nearly, the delivering balls traverse per min.

Required the draught of a carding engine from the following particulars?

Lap rollers at carding engine traverse 1,862576 inches per minute.

Calender rollers, or delivering balls, traverse 238,117572 inches per minute.

1,862576)238,117572(127,843 draught of carding engine.

1862576

5185997
3725152

14608452
13038032

15704200
14900608

8035920
7450304

5856160
5587728

268432

Required the draught of a carding engine from the following particulars?

Wheel on calender or delivering ball shaft, 28 teeth.
Wheel on doffer cylinder end, 130 teeth.
Wheel on feed roller shaft, 13 teeth.
Wheel on feed rollers, 128 teeth.
Wheel on feed roller end for driving lap rollers, 17 teeth.
Wheel on lap roller end, 46 teeth.
Diameter of calender or delivering balls, 3,875 inches.
Diameter of lap rollers, 3,75 inches.

N. B.—The carrying, or connecting wheels are omitted, as in former examples.

(Continued.)

28 teeth wheel on delivering ball shaft.
13 teeth wheel on feed roller shaft.

84
28

364
17 teeth wheel on feed roller end, driving lap rollers.

2548
364

6188
3,75 inches diameter of lap rollers.

30940
43316
18564

23205,00 divisor.

130 teeth wheel on doffer cylinder.
128 teeth wheel on feed rollers.

3840
128

16640
46 teeth wheel on end of lap roller.

99840
66560

765440
3,875 diameter of delivering balls.

3827200
5358080
6123520
2296320

2966080,000 dividend.

(Continued.)

23205)2966080,000(127,8 draught of carding engine.
23205

64558
46410

181480
162435

190450
185640

4810

If one preparation in the card room requires 8 carding engines, and each carding engine delivers 238,117572 inches of carding per minute; what length will the whole preparation of carding engines deliver in one day, allowing them to work 10 hours?

238,117572 in. of carding delivered per min. (1 engine.)
60 minutes 1 hour.

14287,054320 inches delivered per hour. (1 engine.)
10 hours equal to 1 day.

142870,543200 inches delivered per day. (1 engine.)
8 carding engines, one preparation.

inches.
1 ft.=12)1142964,345600 inches of carding delivered per day from 1 preparation.
1 yd.=3 ft.)95247,0288 feet of carding per day from 1 preparation.

31749,0096 yards of carding per day from 1 preparation.

What length of lap will be required to supply 8 carding engines 1 day, allowing them to produce 1142964,3456 inches of carding, and the draught at the carding engine to be 128?

(See next page.)

Inches of carding.

Draught at card. en. 128)1142964,3456(8929,4 inches of lap required.

1024

1189
1152

376
256

1204
1152

523
512

11

How many weighings of cotton must be fed on the lap machine, (each weighing fed on 30 inches of feed cloth,) to produce 8929,4 inches of lap, allowing the draught at lap machine to be 2,115; and what weight of cotton will it require allowing each weighing to be 24 ounces?

2,115 draught at lap machine.
30 inches, length of feed.

63,450 inches of lap each weighing produces.

63,45)8929,4(140,731, nearly 140¾ weighings of cotton required per day.

6345

25844
25380

46400
44415

19850
19035

8150
6345

1805

140,731 number of weighings of cotton required
24 ounces weight of one weighing. [per day.

562924
281462

4)3377,544

1lb. is 16 oz. { 4) 844,386

211,0965 lbs., or 211lbs. 1½ oz. weight of cotton
16 oz. 1lb. [required per day, for
[1 preparation.

5790
965

1,5440
4 qrs.

2,1760

The foregoing examples are considered sufficient, because whatever principle may be considered best, the calculations must be made in the same way, the consumption and production, whether single or double carding, or for coarse or fine spinning, may be ascertained with the least trouble, and greatest accuracy, by a strict adherence to the rules and examples illustrated.

PARTICULARS OF A CARDING ENGINE.

Speed of main cylinder per minute 108,92 revolutions.
Speed of doffer cylinder per minute 4,213 revolutions.
Speed of lap rollers per minute 0,1581 revolutions.
Speed of feed rollers per minute 0,4278 revolutions.
Speed of licker-in per minute 217,84 revolutions.
Speed of delivering balls per minute 19,56 revolutions.
Speed of crank per minute 248,96 revolutions.
Diameter of main cylinder 37 inches, traversing 12657,77 inches per minute.
Diameter of doffer cylinder 18 inches, traversing 238,24 inches per minute.

Diameter of licker-in 9 inches, traversing 6159,29 inches per minute.

Diameter of lap rollers $3\frac{3}{4}$ inches, traversing 1,862576 inches per minute.

Diameter of feed rollers $1\frac{1}{2}$ inches, traversing 2,016 inches per minute.

Diameter of delivering balls $3\frac{7}{8}$ inches, traversing 238,117572 inches per minute.

Diameter of pulley on main cylinder 14 inches.

Diameter of pulley on main cylinder for crank 16 inches.

Diameter of pulley on crank shaft 7 inches

Diameter of pulley for driving licker-in 14 inches.

Diameter of pulley on licker-in 7 inches.

Crank half radius $1\frac{7}{8}$ inches, or $3\frac{3}{4}$ inches sweep.

Draught between lap rollers and feed rollers 1,08.

Total draught at carding engine 128 nearly.

Weight of lap required to supply a carding engine 1 day, or 10 hours 26lbs. $6\frac{1}{2}$ oz.

Length of carding delivered per engine per day 142870$\frac{1}{2}$ inches.

Length of lap consumed by 1 carding engine per day 1117$\frac{1}{2}$ inches.

DRAWING FRAME.

FIRST HEAD.

The shaft under the drawing frame for driving drawing boxes, makes 163,38 revolutions per minute.—Drums on shaft are 12 inches diameter.—Pulleys on the front rollers are 7 inches diameter; the speed of the front roller is required?

163,38 revols. of shaft per minute.
12 inches diam. of drums on shaft.

Diam. of pulley on front roller, inches. 6)1960,56

326,76 revolutions of front roller per min.

If the front roller of a drawing frame makes 326,76 revolutions per minute, and its diameter be $1\frac{1}{8}$ inches; what will it traverse?

326,76 revolutions of front roller per minute.
1,125 inches diameter of do.

163380
65352
32676
32676

367,60500
3,1416 circumference when the diameter is 1.

2205630
367605
1470420
367605
1102815

1154,8678680 nearly 1155 inches, front roller traverses per minute.

The speed of shaft under rollers, for driving middle and back rollers, is required from the following particulars?

Front roller makes 326,76 revolutions per minute.
Wheel on front roller for driving wheel on shaft 15 teeth.
Wheel on shaft under rollers for driving middle and back rollers, 104 teeth.

326,76 revolutions of front roller per minute.
15 teeth wheel on do.

163380
32676

Wheel on shaft under rollers, } teeth.

104)4901,40(47,128 revolutions of shaft under rols.
416

741
728

134
104

300

300
208

920
832

88

The speed of the middle roller is required from the following particulars?

Revolutions of shaft under rollers 47,128 per minute.
Wheel on shaft for driving middle roller 90 teeth.
Wheel on middle roller 33 teeth.

47,128 revolutions of shaft under rollers
90 teeth wheel on do. [per min.

Wheel on mid. rol., 33 tth.)4241,520(128,53 revolutions of middle
33 roller per minute.

94
66

281
264

175
165

102
99

3

If the middle roller makes 128,53 revolutions per minute, and its diameter be $1\frac{1}{8}$ inches; what will it traverse?

128,53 revolutions of middle roller per minute.
1,125 inches diameter of roller.

64265
25706
12853
12853

144,59625
3,1416 circumference when the diameter is 1.

86757750
14459625
57838500
14459625
43378875

454,263579000 inches, middle roller traverses per min.

The draught between the middle and front roller is required, from the following particulars?

Front roller traverses 1154,867868 inches per minute.
Middle roller traverses 454,26358 inches per minute.

454,26358)1154,867868(2,542 draught between middle and front roller.
90852716

246340708
227131790

192089180
181705432

103837480
90852716

12984764

The speed of the back roller is required, from the following particulars?

Revolutions of shaft under rollers, 47,128 per minute.
Wheel on shaft for delivering back roller, 68 teeth.
Wheel on back roller, 56 teeth.

47,128 revols. of shaft under rollers per min.
68 teeth wheel on do.

377024
282768

teeth.

Wheel on back rol., 56)3204,704(57,22685 revols. of back rol. per min.
280

404
392

127
112

150
112

384

384
336

480
448

320
280

40

If the back roller makes 57,22585 revolutions per minute, and its diameter be $1\frac{1}{8}$ inches; what will it traverse?

57,22685 revols. of back roller per minute.
1,125 inches diameter of do.

28613425
11445370
5722685
5722685

64,38020625
3,1416 circumference when the diam. is 1.

38628123750
6438020625
25752082500
6438020625
19314061875

202,256855955000, or $202\frac{1}{4}$ inches, back roller traverses per minute.

The draught between the back and middle roller is required, from the following particulars?

Middle roller traverses 454,26358 inches per minute.

Back roller traverses 202,25685 inches per minute.

202,25685)454,26358(2,24597 draught between back and middle roller.
40451370

49749880
40451370

92985100
80902740

120823600
101128425

196951750
182031165

149205850
141579795

7626055

N. B.—The total draught of any machine, where there are intermediate draughts, may be found by multiplying the draughts respectively into each other, the sum of which will be the total draught.

The draught may also be found by the wheels, as will appear hereafter.

The speed of the calender rollers, or delivering balls, is required from the following particulars?

Front roller makes 326,76 revolutions per minute.

Wheel on front roller 38 teeth, working into carrying wheels.

Wheel on calender, or delivering ball shaft, 100 teeth.

326,76 revols. of front roller per min.
38 teeth wheel on do.

261408
98028

Whl. on deliv. ball shaft, 100 teeth.)12416,88

24,1688 revolutions of calender, or delivering balls per minute.

The draught between the front roller and calender rollers, or delivering balls, is required from the following particulars?

Front roller traverses 1155 inches per minute.

Calender, or delivering balls traverse 1170,266 inches per minute.

1155)1170,266(1,013 draught between front roller, and delivering balls.
1155

1526
1155

3716
3465

251

If the calender, or delivering balls make 24,1688 revolutions per minute, and their diameters be 3 inches; what will they traverse?

124,1688 revols. of delivering balls per min.
3 inches diameter of do.

372,5064
3,1416 circumference when the diam. is 1.

22350384
3725064
14900256
3725064
11175192

1170,26610624 inches, calender rollers, or delivering balls trav. per min.

The draught at the first head of a drawing frame is required, from the following particulars?

Back roller makes 57,22685 revolutions per minute.

Calender, or delivering balls, make 124,1688 revols. per min.

Diameter of back roller $1\frac{1}{8}$ inch, or 1,125 inch.

Delivering balls 3 inches in diameter.

57,22685 revolutions of back roller per minute.
1,125 diameter of do.

28613425
11445370
5722685
5722685

64,38020625 divisor.

124,1688 revolutions of delivering balls.
3 inches diameter of do.

372,5064 dividend.

64,38)372,5064(5,786 draught at first head of drawing frame.
32190

50606
45066

55404
51504

39000
38628

372

The draught at the first head of a drawing frame is required from the following particulars?

Calender, or delivering ball, traverses 1170,2661 inches per minute.
Back roller traverses 202,2568 inches per minute.

202,2568)1170,2661(5,786 draught at first head of drawing.
10112840

15898210
14157976

17402340
16180544

12217960
12135408

82552

The draught at the first head of drawing is required from the following particulars?

Wheel on front roller 15 teeth, working into wheel 104 teeth on shaft under rollers.

Wheel on the other end of shaft under rollers 66 teeth, working into wheel on back roller 56 teeth.

Wheel on calender, or delivering ball shaft, 100 teeth, driven by carrier wheels from wheel on front roller, 38 teeth.

Diameter of back rollers 1 ½ inch, or 1,125 inch.

Diameter of calender, or delivering balls 3 inches. *(See next page.)*

100 teeth wheel on delivering ball shaft.
15 teeth wheel on front roller.

1500
68 teeth wheel on end of shaft on the rols.

12000
9000

102000
1,125 inch diameter of back rollers.

510000
204000
1122000

114750,000 divisor.

38 teeth wheel on front roller, driving deliv. ball shaft.
104 teeth wheel on shaft under roller.

152
380

3952
56 teeth wheel on back roller.

23712
19760

221312
3 inches, diameter of delivering balls,

14750)663936(5,786 nearly, draught at first head of drawing frame.
573750

901860
803250

986100
918000

681000
688500—nearly.

What length of carding will it require, to supply the first head of a drawing frame, having 2 pair of calender, or delivering balls in front, and 6 ends of carding put up at back to each pair of calender, or delivering balls, the back roller traversing 202,256856 inches per minute?

202,256856 or rather more than 202¼ inches.
12 ends of carding to 2 pair of balls.

2427,082272
60 minutes 1 hour.

145624,936320 inches per hour required.

If there be 8 carding engines to a preparation, producing 1142964 inches per day, how long will it require the first head of a drawing frame to work, to consume what the carding engines produce, allowing the first head of drawing frame to consume 145625 inches per hour?

145625)1142964(7,8486 hours.
1019375 60 minutes 1 hour.

1235890 50,9160, or 7 hours 51 min. nearly.
1165000

708900
582500

1264000
1165000

990000
873750

116250

N. B.—It will require the first head of a drawing frame to work 7 *hours* 51 *minutes successively, to consume the production of* 8 *carding engines, according to the two foregoing examples.*

The consumption and production of any piece of machinery, will be ascertained in the same way; therefore it will not be repeated.

What weight of cotton will it require to be fed on the lap machine, to produce 1142964 inches of carding per day, (which is required to supply the first head of drawings,) allowing 24 ounces of cotton to be fed on 30 inches of feed cloth at the lap machine, and the draught at the carding engine to be 127,8, and the draught at lap machine 2,115?

Multiply the draughts together, and that product by the number of inches of feed cloth that your weight of cotton is fed on at lap machine, for a divisor, and the number of inches of carding required to supply your drawing frame, by the weight fed on the given number of inches of feed cloth at lap machine, for a dividend, and the quotient will be the weight in ounces required.

127,8 draught at carding engine.
2,115 draught at lap machine.

6390
1278
1278
2556

270,2970 30 inches length of feed cloth at lap machine.

8108,9100 divisor.

142964 inches of carding required.
24 ounces, weight fed on feed cloth at lap machine.

4571856
2285928

8108,91)27431136(3382,8 ounces, or rather more than 211lbs.
2432673 8⅞ oz. weight of cotton required to be fed on the lap machine.

3104406
2432673

6717330
6487128

2302020
1621782

6802380
6487128

315252

DRAWING FRAME.

SECOND HEAD.

The front rollers of the different heads of a drawing frame are generally of the same speed, and the only difference is the draught between the rollers.

If the front roller makes 326,76 revolutions per minute; the revolution of the middle roller is required, from the following particulars?

Wheel on end of front roller, for driving shaft under rollers, 14 teeth.
Wheel on end of shaft under rollers, 104 teeth.
Wheel on end of shaft under rollers, driving middle roller, 90 teeth.
Wheel on middle roller, 33 teeth.

104 teeth wheel on shaft under rollers.
33 teeth wheel on middle roller.

312
312

3432 divisor.

326,76 revolutions of front roller per minute.
14 teeth wheel on do.

130704
32676

4574,64
90 teeth wheel on shaft under rollers.

3432)411717,60(119,9643, or nearly 120 revolutions,
3432 which middle roller makes per min.

6851
3432

34197
30888

33096
30888

22080
20592

14880

14880
13728

11520
10296

1224

If the middle roller at second head of drawing, makes 119,9643 revolutions per minute; what will it traverse, if the diameter be $1\frac{1}{8}$ inch?

119,9643 revolutions of middle roller per min.
1,125 = $1\frac{1}{8}$ inch diameter of roller.

5998215
2399286
13196073

134,9598375
3,1416 circumference when diameter is 1.

8097590250
1349598375
5398393500
1349598375
4048795125

423,98982549000, or nearly 424 inches, the middle roller traverses per minute.

If the front roller of the second head of drawing, traverses 1154, 867868 inches, and the middle roller traverses 423,989825 inches per minute; what draught is there between the middle and front rollers?

423,989825)1154,867868(2,72 draught between middle and front rols.
847979650

3068882180
2967928775

1009534050
847979650

161554400

Required the draught between the middle and front rollers of the second head of drawing, from the following particulars?

Front roller makes 326,76 revolutions per minute.

Middle roller makes 119,96 revolutions per minute.

119,96)326,76(2,72 draught between the middle and front rollers, second head of drawing.
23992

86840
83972

28680
23992

4688

The speed of back roller at second head of drawing is required, from the following particulars?

Speed of front roller, 326,76 revolutions per minute.

Wheel on end of front roller for driving shaft under rollers, 14 teeth.

Wheel on end of shaft under rollers, 104 teeth.

Wheel on end of shaft under rollers, driving back roller, 68 teeth.

Wheel on end of back roller, 56 teeth.

104 teeth wheel of shaft under roller.
56 teeth wheel of back roller.

624
520

5824 divisor.

326,76 revolutions of front roller per minute.
14 teeth wheel on end of front roller.

130704
32676

4574,64
68 teeth wheel on shaft under rollers.

3659712
2744784

311075,52 dividend.

(*See next page.*)

5824)311075,52(53,412 revolutions of back roller per min.
29120

19875
17472

24035
23296

7392
5824

15680
11648

4032

If the back roller at the second head of drawing, makes 53,412 revolutions per minute, and its diameter be $1\frac{1}{8}$ inch; what will it traverse?

53,412 revolutions of back roller per minute.
1,125 = $1\frac{1}{8}$ inch diameter of do

267060
106824
587532

60,088500
3,1416 circumference when the diameter is 1.

3605310
600885
2403540
600885
1802655

188,77403160 inches, the back roller traverses per min.

The draught between the back and middle rollers, at the second head of drawing, is required from the following particulars?
Middle roller traverses 424 inches per minute.
Back roller traverses 188,774 inches per minute.

188,774)424,000(2,246 draught between middle and bk. rols. 2d. head of drawing.
377548
464520
377548
869720
755096
1146240
1132644
13596

The draught between the back and front roller is required, from the following particulars?
Front roller traverses 1154,867868 inches per minute.
Back roller traverses 188,774 inches per minute.

188,774)1154,867868(6,117 draught between the back and front rollers, second head of drawing.
1132644
222238
188774
334646
188774
1458728
1321418
137310

The total draught at the second head of drawing is required, from the following particulars?
Wheel on calender, or delivering balls' shaft, 100 teeth.
Wheel on front roller, 38 teeth.
Wheel on front roller, working shaft under front rollers, 14 teeth.
Wheel on shaft under rollers, 104 teeth.
Wheel on shaft under rollers, 68 teeth, working into a wheel on back rollers, 56 teeth.
Diameter of calender or delivering balls, 3 inches.
Diameter of back roller, 1⅛ inch, or 1,125 inch.

Multiply the number of teeth in the driving wheels together, respectively, and that product by the diameter of the back roller, for a divisor, and the number of teeth in the driven wheels together. and that product by the diameter of the calender, or delivering balls, for a dividend, and the quotient will be the real or total draught, as in the following example.

100 teeth wheel on delivering ball shaft.
14 tth. whl. on front rol., driving shaft under rols.

1400
68 teeth wheel on shaft under rollers.

11200
8400

95200
9 or $1\frac{1}{8}$ inch diameter of back roller.

856800 divisor.

38 teeth wheel on front rollers.
104 teeth wheel on shaft under rollers.

152
380

3952
56 teeth wheel on back roller.

23712
19760

221312
24 or $\frac{24}{8}$ = 3 inches, diameter of deliv. balls.

885248
442624

856800)5311488(6,199, or 6,2 nearly, draught between back roller and delivering balls.
5140800

1706880
856800

8500800
7711200

7896000

7896000
7711200

184800

If the third, or last head of drawing be same as the second head, what will the total draught at the three heads of drawing be, and what doubling will there be, allowing 6 ends to be put up against each pair of calender, or delivering balls, at each head of drawing?

5,786 draught at first head of drawing.
6,199 draught at second head of drawing.

52074
52074
5786
34716

35,867414
6,199 draught at third head of drawing.

322806726
322806726
35867414
215204484

222,342099386 rather more than 222 $\frac{3}{10}$, total draught at the three heads of drawing.

DOUBLING.

6 ends of carding, first head of drawing frame.
6 ends of drawing, second head of drawing frame.

36
6 ends of drawing, third head of drawing frame.

216 total doubling at drawing frame.

N.B.—The above doubling is small, considering the quantity of doubling at many places, however that may be arranged according to the opinion of managers &c.

If two pairs of calender, or delivering balls, at the first head of drawing, traverse 1120,266 inches each pair per minute; what length of drawing will they produce in 7,8476 hours, or 7 hours 51 minutes?

1120,266 inches, delivering balls traverse per min.
2 pairs at each head of drawing.

2240,532
7,8476 hours.

13443192
15683724
8962128
17924256
15683724

17582,7989232
60 minutes 1 hour.

1 ft. = 12 in.) 1054967,9353920 inches produced in 7,8476 hours.

1 yard = 3 ft.) 87913,994616 feet produced in 7,8476 hours.

29304,664872 yards produced in 7,8476 hours.

If the back roller at the second head of drawing traverses 188,774 inches per minute, and 12 ends be put up; *i. e.*, 6 ends to each pair of delivering balls; what time must it work to consume 1054968 inches, which the first head of drawing produces?

188,774 inches, back roller traverses per minute.
12 ends, *i. e.*, 6 to each pair of deliv. balls.

2265,288 inches consumed per minute.

2265,288) 1054968,0 (465,71 minutes, or 7 hours 45 minutes 42$\frac{8}{9}$ seconds, the second head must work, to consume what the first head produces.

9061152
14885280
13591728
12935520
11326440
16090800
15857016
2337840

2337840
2265288
72552

If 2 pairs of delivering balls in front of the first head of drawing, traverse 1170,266 inches each per minute; what length will they produce if they work successively 7 hours 51 minutes, or 7,8476 hours?

1170,266 inches, delivering balls traverse per min.
2 pairs of deliv. balls traverse in first head.

2340,532
60 minutes 1 hour.

140431,920
7,8476 hours.

84259152
98302344
56172768
112345536
98302344

1102053,535392 inches, 2 pairs of delivering balls at first head of drawing produces in 7,8476 hours.

or 7 hours 51 minutes.

If 12 ends be put up at the second head of drawing, that is, 6 ends to each pair of delivering balls, and the back roller traverses 188,774 inches per minute; what time must the second head of drawing work, to consume what the first head produces, say 1102053,5 inches?--188,774 inches back roller traverses per minute.

12 ends.

2265,288 divisor.

2265,288)1102053,5(486,5 minutes nearly, or 8 hours 6½ minutes.
9061152

19593830
18122304

14715260
13591728

11235320
11326440—nearly.

It requires 8 hours 6½ minutes for the second head of drawing to work, to consume what the first head produces.

N. B.—The consumption and production of the third head of drawing, will be same as the second head.

PARTICULARS OF A DRAWING FRAME.

First head, front roller, 326,76 revolutions per minute.
Middle roller, 128,53 revolutions per minute.
Back roller, 57,226 revolutions per minute.
Delivering balls, 124,168 revolutions per minute.
Diameter of rollers, 1⅛ inch.
Diameter of delivering balls, 3 inches.
Draught between back and middle rollers, 2,246.
Draught between middle and front rollers, 2,542.
Draught between front roller and delivering balls, 1,013.
Total draught at the first head of drawing, 5,786.

Second head, front roller, 326,76 revolutions per minute.
Middle roller, 120 revolutions per minute.
Back roller, 53,412 revolutions per minute.
Delivering balls, 124,168 revolutions per minute.
Diameter of rollers, 1⅛ inch.
Diameter of delivering balls, 3 inches.
Draught between back and middle roller, 2,246.
Draught between middle and front roller, 2721.
Total draught at the second head of drawing, 6,123.

N. B.—The third head of drawing is the same as the second head.

First head, back roller traverses 202,256 inches per minute.
Delivering balls traverse 1170,266 inches per minute.
Back roller consumes 1142964 inches, or 211lbs. 8¾ oz. in 7 hours 51 minutes.
Delivering balls produce 1102053 inches, or 211lbs. 8¾ oz. in 7 hours 51 minutes.

Second and third head back rollers traverse 188,774 inches per minute.
Delivering balls traverse 1170,266 inches per minute.
Back rollers consume 1102053 inches, or 211lbs. 8¾ oz. in 8 hours 6½ minutes.
Delivering balls produce 1102603 inches, or 211lbs. 8¾ oz. in 8 hours 6½ minutes.

N. B.—The above weights of drawing are the gross weight of cotton, the net weight will be according to its proportionate size, or girt, in any operation as will be shewn hereafter.

DYER'S PATENT TUBE FRAME.

THERE can no frame be equalled to the patent tube frame for the production of quantity, and it is well calculated for coarse and medium yarns. I have conversed with many masters, managers, and overlookers, who give a decided preference to this frame, not only on account of the quantity of roving it produces, but for drawing regular in the rollers at the spinning operation, and on account of being compressed and containing no twist. It answers well for all rovings below a four hank, and with proper attention to cleaning, oiling, &c., a very even thread of yarn will be produced from the roving.

SPEEDS, DRAUGHTS, &c., OF DYER'S PATENT TUBE FRAME.

Speed of shaft for driving frame, 143 revolutions per minute.
Diameter of drum on said shaft, 30 inches.
Diameter of pulley on frame, 9¾, or 9,75 inches.

143 revolutions of shaft per minute.
30 inches, diameter of drum on shaft.

Diam. of pul. 9,75 in.)4290,00(440 revolutions per minute of front
3900 rollers, second head.

3900
3900

N. B.—There are 2 sets, or tiers of rollers to this frame, the back or receiving rollers are called the first head, and the front or delivering rollers, the second head.

The speed of the middle rollers is required from the following particulars?

Revolutions of front rollers per minute, 400.
Wheel on front rollers 21 teeth, working into stud wheel 42 teeth.
Wheel on same stud 30 teeth, working into wheel 32 teeth on the end of middle rollers.

(See next page.)

440 revolutions of front roller per minute.
21 teeth wheel on do.

440
880

9240
30 teeth wheel on stud.

277200 dividend.

42 teeth wheel on stud.
32 teeth wheel on middle roller.

84
126

1344 divisor.

1344)277200(206,25, or 206¼ revols. of mid. rols. per min.
2688

8400
8064

3360
2688

6720
6720

The speed of the back rollers is required from the following particulars?

Revolutions of front rollers per minute, 440.

Wheel on front rollers 23 teeth, working into wheel 44 teeth on stud; on same stud there is a wheel 20 teeth, working into wheel 41 teeth on back rollers.

44 teeth wheel on stud.
41 teeth wheel on back roller.

44
176

1804 divisor.

(Continued.)

440 revolutions of front roller per minute.
23 teeth wheel on do.

1320
880

10120
20 teeth wheel on stud.

202400 dividend.

1804)202400(112,195 revolutions of back roller per minute.
1804

2200
1804

3960
3608

3520
1804

17160
16236

9240
9020

220

The speed of the front rollers at the first head, is required from the following particulars?

Revolutions of back roller, second head, per minute, 112,195.

Wheel on back roller, second head 41 teeth, working into carrying wheel 41 teeth on stud, which works into wheel 46 teeth on front roller, first head.

(See next page.)

112,195 revols. of back rol., 2nd. head, per min.
41 teeth wheel on do.

112195
448780

Whl. on front rol. first head, 46)4599,995(99,9, or 100 revols. nearly, front rols. first head, per min.
414

459
414

459
414

45

The speed of the middle rollers at the first head, is required from the following particulars?

Revolutions of front rollers per minute, 100.

Wheel on front rollers 21 teeth, working into a wheel on stud 42 teeth; wheel 30 teeth on same stud, works into wheel 32 teeth on middle roller.

42 teeth wheel on stud.
32 teeth wheel on middle roller.

84
126

1344 divisor.

100 revolutions of front roller per minute.
21 teeth wheel on do.

2100
30 teeth wheel on stud.

1344)63000(46,875 revols. of mid. rol per min.
5376

9240
8064

11760
10752

10080

10080
9408

6720
6720

The speed of the back roller at the first head, is required from the following particulars?

Revolutions of front rollers per minute, 100.

Wheel on front rollers 27 teeth, working into stud wheel 58 teeth; on same stud there is a wheel 17 teeth, working into wheel 58 teeth on back rollers.

58 teeth wheel on stud.
58 teeth wheel on back rollers.

464
290

3364 divisor.

100 revolutions of front rollers per minute.
27 teeth wheel on do.

2700
17 teeth in wheel on stud.

18900
2700

3364)45900(13,644 revolutions of back roller per minute.
3364

12260
10092

21680
20184

14960
13456

15040
13456

1584

N. B.—When working the speeds of rollers, the driven wheels multiplied into each other will be the divisor.

The speed of the friction rollers is required from the following particulars?

Revolutions of front rollers, second head, per minute, 440.

Wheel on front rollers 28 teeth, working into wheel 59 teeth on bevil shaft; on the other end of bevil shaft there is a wheel 32 teeth, working into wheel 50 teeth on friction roller shaft.

59 teeth wheel on bevil shaft.
50 teeth wheel on friction roller shaft.

2950 divisor.

440 revolutions of front rollers per minute.
28 teeth wheel on do.

3520
880

12320
32 teeth wheel on bevil shaft.

24640
36960

394240

2950)394240(133,64 revolutions of friction rols. per min.
2950

9924
8850

10740
8850

18900
17700

12000
11800

200

The speed of the tubes is required from the following particulars?

Revolutions of pulley shaft per minute, 440.
Diameter of pulley on said shaft, 18 inches.
Diameter of tubes $\frac{7}{8}$ inch, or ,875 inch.

440 revolutions of pulley shaft per min.
18 inches, diam. of pul. on said shaft.

3520
440

Diam. of tubes, ,875 in.)7920(9051,428 revols. of tubes per min.
7875

4500
4375

1250
875

3750
3500

2500
1750

7500
7000

500

The draught between the back and middle rollers at the first head, is required from the following particulars?

Revolutions of back rollers per minute, 13,644.
Revolutions of middle rollers per minute, 46,875.
Diameters of back and middle rollers, 1 inch.

13,644)46,875(3,435, draught between back and middle roller.
40932

59430
54576

48540
40932

76080
68220

7860

The draught between the middle and front rollers, is required from the following particulars?

Revolutions of middle rollers per minute, 46,875.
Revolutions of front rollers per minute, 100.
Diameter of middle rollers, 1 inch.
Diameter of front rollers, $1\frac{1}{8}$ inch, or 1,125 inch.

100 revolutions of front rollers per minute.
1,125 inch diameter of do.

46,875)112,500(2,4 draught between middle and front rols.
93750

187500
187500

The total draught at the first head, is required from the following particulars?

Draught between back and middle rollers, 3,435.
Draught between middle and front rollers, 2,4.

3,435
2,4

13740
6870

8,2440, nearly $8\frac{1}{4}$ total draught, first head.

The draught between the front roller first head, and the back roller second head, is required from the following particulars?

Revolutions of front rollers first head per minute, 100.
Revolutions of back rollers second head per minute, 112,195.
Diameter of front rollers first head, $1\frac{1}{8}$ inch, or 1,125 inch.
Diameter of back rollers second head, 1 inch.

100 revols. of front roller per min. first head.
1,125 inches diameter of do.

112,500 divisor.

112,5)112,195(0,997 diminution of draught between the two heads of rollers.
10125

10945
10125

8200
7875

325

N. B.—On account of the distance between the first and second head of rollers, a draught would be injurious.

The draught between the back and middle rollers at the second head, is required from the following particulars?

Revolutions of back rollers per minute, 112,195.
Revolutions of middle rollers per minute, 206,25.
Diameters of middle and back rollers, 1 inch.

112,195)206,250(1,8383 draught between back and middle rollers second head.
112195

940550
897560

429900
336585

933150
897560

355900
336585

19315

The draught between the middle and front rollers at the second head, is required from the following particulars?

Revolutions of middle rollers per minute, 206,25.
Revolutions of front rollers per minute, 440.
Diameter of middle roller, 1 inch.
Diameter of front roller, $1\frac{1}{8}$ inch, or 1,125 inch.

1,125 inch, diameter of front rollers.
440 revolutions of front rollers per minute.

45000
4500

206,25)495000(2,4 draught between mid. and front rols.
41250

82500
82500

The draught between the front rollers and friction rollers, is required from the following particulars?

Revolutions of front rollers per minute, 440.
Revolutions of friction rollers per minute, 133,64.
Diameter of friction rollers, 4 inches.
Diameter of front rollers, $1\frac{1}{8}$ inch, or 1,125 inch.

440 revolutions of front rollers.
1,125 inches diameter of do.

45000
4500

495,000 divisor.

133,64 revolutions of friction rollers.
4 inches diameter of do.

495)534,56(1,08 nearly, draught between
495 front rollers and friction rols.

3956
3960—nearly.

The total draught at the second head, is required from the follow-particulars? (including draught between front rollers and friction rollers.)

Draught between back and middle rollers, 1,8383.
Draught between middle and front rollers, 2,4.
Draught between front and friction rollers, 1,08.

1,8383 draught between back and middle rollers.
2,4 draught between middle and front rols.

73532
36766

4,41192 draught between back and front rollers.
1,08 draught between front and friction rols.

3529536
4411920

4,7648736 total draught between back rollers second head, and friction rollers.

The total draught at Dyer's patent tube frame, is required from the following particulars?

Draught at first head, 8,244
Draught at second head, and friction rollers, 4,764

32976
49464
57708
32976

39,274416 total draught.

The total draught at Dyer's patent tube frame, is required from the following particulars?

Wheel on friction roller shaft 50 teeth, working into
Wheel on bevil shaft 32 teeth.
Wheel on top of shaft 59 teeth, working into
Wheel on front roller second head 28 teeth.
Wheel on front roller second head 23 teeth, working into
Wheel on stud 44 teeth.

Wheel on same stud 20 teeth, working into
Wheel on back roller second head 41 teeth, working into a
Wheel on stud 41 teeth, which works into
Wheel on front roller first head 46 teeth.
Wheel on front roller 27 teeth, working into
Wheel on stud 58 teeth.
Wheel on same stud 17 teeth, working into
Wheel on back roller first head 58 teeth.
Diameter of friction pulley, 4 inches.
Diameter of back roller first head, 1 inch.

50 teeth wheel on friction roller shaft.
59 teeth wheel on top of bevil shaft.

2950
23 teeth wheel on front roller second head.

8850
5900

67850
20 teeth wheel on second head.

1357000
41 teeth wheel on stud between the heads.

1357000
5428000

55637000
27 teeth wheel on front roller first head.

389459000
111274000

1502199000
17 teeth wheel on stud first head.

10515393000
1502199000

25537383000 divisor.

(Continued.)

32 teeth wheel on bevil shaft.
28 teeth wheel on front roller second head.

256
64

896
44 teeth wheel on stud second head.

3584
3584

39424
41 teeth wheel on back roller.

39424
157696

1616384
46 teeth wheel on front roller.

9698304
6465536

74353664
58 teeth wheel on stud.

594829312
371768320

4312512512
58 teeth wheel on back roller first head.

34500100096
21562562560

250125725696
4 inches diameter of friction pulley.

1000502902784

(Continued.)

25537383,000)1000502902,784(39,178 total draught between back rols. first head and friction rols.
76612149
234381412
229836447
45449657
25537383
199122748
178761681
203610674
204299064—nearly.

N. B.—The small difference between this and the other method arises from the decimal parts; however, the last method is the most accurate.

If the back rollers at the first head make 13,644 revolutions per minute, and their diameter be 1 inch; what will they traverse?

13,644
3,1416 circumference when the diam. is 1.
81864
13644
54576
13644
40932
42,8639904 nearly 43 inches, back rollers traverse at first head per minute.

If 22 drawings be put up at the back of the patent tube frame; what length will it consume per minute, if the back rollers traverse 42,864 inches per minute?

42,864 inches back rollers traverse per minute.
22 drawings put up at the back of the frame.
85728
85728
943,008 inches of drawing consumed per minute.

What time must a patent tube frame work to consume 551027 inches of drawing, if it consumes 943 inches per minute?

943)551027(584 minutes, or 9 hours, 44 minutes tube frame must work successively, to consume what the last head of drawing produces.

4715
7952
7544
4087
3772
315

N. B.—There are 1102054 *inches of drawing produced at the last head of drawings; but on account of the drawing being put up double at the back of the frame, only one half the length is reckoned for consumption, i. e.* 551027 *inches.*

If the front roller of a patent tube frame makes 440 revolutions per minute, and the diameter of the rollers be $1\frac{1}{8}$ inch; what length of roving will the frame produce, if it contains 22 tubes, and works 9 hours, 44 minutes successively in 1 day?

1,125 diameter of front rollers = $1\frac{1}{8}$ inch.
3,1416 circumference when diameter is 1.

6750
1125
4500
1125
3375

35,343000
440 revolutions of front rollers per minute.

1413720
141372

1555,0920 inches, each tube receives per minute.
22 drawings put up at back of the frame.

3110184
3110184

34212,024 inches, or 950 yards, 12 inches, or 1 hank 110 yards, 12 inches, tube frame produces per minute, i. e., if there be no draught betwixt the front rollers and the friction rollers. *(Continued.)*

34212 inches of roving produced per minute.
584 minutes=9 hours, 44 minutes.

136848
273696
171060

1 yd.=36 in. { 6)19979808 inches of roving produced.
6)3329968

Yards in a hank, 840)554994,66(660,7 hanks, or 660 hanks, 4 leas,
5040 114 yards.

5099
5040

5946
5880

66

If 660 hanks of roving weigh 211½lbs. what hank roving will it be?

211,5)660,7(3,124, or 3⅛ hank roving nearly.
6345

2620
2115

5050
4230

8200
8460—nearly.

N. B.—If the 211½*lbs. of cotton had been carried through all the different processes of carding, drawing, and roving, without any loss, it would have produced a roving equal to* 3,124 *hanks to the pound, but as loss is sustained in the different processes, that loss can only be accurately ascertained by working the weight of cotton consumed regularly through all the processes, and ascertaining the net weight of roving which will be according to the following example.*

If the roving be 3,75 hanks to the pound; what will be the net weight of 660,7 hanks, and what weight will be lost at the different processes, allowing 211½lbs. to have been consumed at the carding engines?

Hank roving, 3,75)660,7(176,186lbs. weight of roving produced from 211½lbs. of cotton.

375

2857
2625

2320
2250

700
375

3250
3000

2500
2250

250

211,5lbs. of cotton consumed at 1 prep. per day.
176,186lbs. of roving produced at do.

35,314lbs. loss sustained in working through the different processes, which is nearly 2¼ ounces to the pound.

If a patent tube frame produces 176,186lbs. of roving per day; what weight of roving will it produce in 6 days?

176,186lbs. of roving produced per day.
6 days.

1057,116lbs., or 1057lbs. 1¾ oz, per week.
16 oz.=1lb.

696
116

1,856 oz.
4 qrs.=1 oz.

3,424 qrs.

PARTICULARS OF DYER'S PATENT TUBE FRAME.

Revolutions of friction rollers per minute, 133,64.
Revolutions of front rollers second head per minute, 440.
Revolutions of middle rollers second head per minute, 206,25.
Revolutions of back rollers second head per minute, 112,195.
Revolutions of front rollers first head per minute, 100.
Revolutions of middle rollers first head per minute, 46,875.
Revolutions of back rollers first head per minute, 13,644.
Revolutions of tubes per minute, 9051,428.
Diameter of friction rollers, 4 inches.
Diameter of tubes, $\frac{7}{8}$ inch.
Diameter of front rollers first and second head, $1\frac{1}{8}$ inch.
Diameter of middle and back rollers first and second head, 1 inch.
Tube traverses per minute, 24881 inches.
Friction rollers traverse per minute, 1679 inches.
Front rollers second head traverse per minute, 1555 inches.
Middle rollers second head traverse per minute, 648 inches.
Back rollers second head traverse per minute, 352,5 inches.
Front rollers first head traverse per minute, 353,4 inches.
Middle rollers first head traverse per minute, 147,24 inches.
Back rollers first head traverse per minute, 42,85 inches.

DRAUGHTS.

Draught between back and middle rollers first head, 3,435.
Draught between middle and front rollers first head, 2,4.
Draught between front rollers first head and back rollers second head, 0,997.
Draught between back and middle rollers second head, 1,8383.
Draught between middle and front rollers second head 2,4.
Draught between front rollers and friction rollers, 1,08.
Total draught at the first head, 8,244.
Total draught at the second head, 4,4119.
Total draught at tube frame, 39,178.

N. B.—The consumption and production is according to the traversing of the rollers, which in all cases will be found by multiplying the number of revolutions of the rollers by their circumferences.

The distance of the rollers from each other, must be regulated according to the staple and quality of cotton.

SLABBING FRAME.

The speed of the principal, or main shaft at slabbing frame, is required from the following particulars?

Revolutions of shaft per minute driving slabbing frame, 114.
Diameter of drum on said shaft, 16 inches.
Diameter of pulley on frame shaft, 15 inches.

114 revols. of driving shaft per min.
16 diameter of drum on do.

684
114

Diam. of pulley, 15 in.)1824(121,6 revols. of frame shaft per min.
15

32
30

24
15

90
90

The speed of the front rollers is required from the following particulars?

Revolutions of frame shaft per minute, 121,6.
Wheel on said shaft 64 teeth, working into carrying wheel 138 teeth on stud, which works into a wheel 60 teeth on front rollers.

121,6 revols. of frame shaft per min.
64 teeth wheel on said shaft.

4864
7296

Wheel on front roller, 60 tth.)7782,4

129,706 revols. of front rols. per min.

The speed of the middle rollers is required from the following particulars?

Revolutions of front rollers per minute, 129,7.

Wheel on front rollers 24 teeth, working into wheel 70 teeth on stud; on the same stud a wheel 25 teeth works into wheel 56 teeth on back rollers; wheel on the other end of back rollers 30 teeth, working into wheel 64 teeth on stud, which works into wheel 27 teeth on middle rollers.

129,7 revolutions of front rollers per minute.
24 teeth wheel on do.

5188
2594

3112,8
25 teeth wheel on stud. (Change pinion.)

155640
62256

77820,0
30 teeth wheel on back roller.

2334600 dividend.

70 teeth wheel on stud.
56 teeth wheel on back rollers.

3920
27 teeth wheel on middle roller.

27440
7840

105840 divisor

(Continued.)

105840)2334600(22,0578 revols. of mid. rols. per minute.
211680

217800
211680

612000
529200

828000
740880

871200
846720

24480

The speed of the back rollers is required from the following particulars?

Revolutions of front rollers per minute, 129,7.

Wheel on front rollers 24 teeth, working into wheel 70 teeth on stud; wheel 25 teeth on same stud, works into wheel 56 teeth on back rollers.

129,7 revolutions of front rollers per min.
24 teeth wheel on do.

5188
2594

3112,8
25 teeth wheel on stud.

155640
62256

77820,0 dividend.

70 teeth wheel on stud.
56 teeth wheel on back rollers.

3920 divisor.

(Continued.)

3920)77820(19,852 revolutions of back role. per minute.
3920

38620
35280

33400
31360

20400
19600

8000
7840

160

The traversing of the front, middle, and back rollers, are required from the three foregoing examples, allowing the front rollers to be $1\frac{1}{8}$ inch, and the middle and back rollers 1 inch diameter?

129,7 revolutions of front rollers per minute.
1,125 inches, diameter of do.

6485
2594
1297
1297

145,9125
3,1416 circumference when diameter is 1.

8754750
1459125
5836500
1459125
4377375

458,39871000 inches, front roller traverses per minute.

(Continued.)

22,0578 revolutions of middle rollers per min.
3,1416 circumference when the diameter is 1.

1323468
220578
882312
220578
661734

69,29678448 inches, middle rollers traverse per min.

19,852 revolutions of back rollers per min.
3,1416 circum. when the diameter is 1.

119112
19852
79408
19852
59556

62,3670432 inches, back rollers traverse per min.

The draught between the back and middle rollers, the draught between the middle and front rollers, and the total draught is required from the three foregoing examples?

62,367)69,29678(1,111, or rather more than 1$\frac{1}{9}$ draught, between back and middle rollers
62367

69297
62367

69308
62367

69410
62367

7043

(Continued.)

69,2967)458,39870(6,615 draught between middle and front rollers.
4157802

4261850
4157802

1040480
692967

3475130
3464835

10295

62,367)458,3987(7,35 draught between back and front rollers, or total draught at slabbing frame.
436569

218297
187101

311960
311835

125

The draught between the back and middle rollers, is required from the following particulars?

Wheel on back rollers 30 teeth, working into wheel 64 teeth on stud, which works into wheel 27 teeth on middle roller.

Diameter of back and middle rollers, each 1 inch.

Wheel on middle roller, 27 teeth { 3)30 teeth wheel on back rollers.
9)10

$1\frac{1}{9}$ draught between back and middle rollers.

The draught between the middle and front rollers is required from the following particulars?

Wheel on front roller 24 teeth, working into wheel 70 teeth on stud; wheel 25 teeth on same stud, working into wheel 56 teeth on back rollers; on the other end of back rollers, wheel 30 teeth working into wheel 64 teeth on stud; same stud wheel working wheel 27 teeth on middle rollers.

Diameter of front rollers, $1\frac{1}{8}$, or 1,125 inch.

Diameter of back rollers, 1 inch.

DRIVING WHEELS.

24 teeth wheel on front rollers.
25 teeth wheel on stud working back rols.

120
48

600
30 teeth wheel on back rollers.

18000
8, or 1 inch diameter of middle rollers.

44000 divisor.

DRIVEN WHEELS.

70 teeth wheel on stud.
56 teeth wheel on back rollers.

3920
27 teeth wheel on middle rollers.

27440
7840

105840
9, or $\frac{1}{9}$ inch diameter of middle rollers.

144000)952560(6,615 draught between middle and front rollers.
864000

885600
864000

216000

216000
144000

720000
720000

The total draught is required from the following particulars?

Wheel on front rollers 24 teeth, working into wheel 70 teeth on stud, wheel on same stud 25 teeth, working into wheel 56 teeth on back rollers.

Diameter of back rollers, 1 inch.
Diameter of front rollers, $1\frac{1}{8}$, or 1,125 inch.

DRIVING WHEELS.

24 teeth wheel on front rollers.
25 teeth wheel on stud. (Change pinion.)

120
48

600
8, or 1 inch diameter of back rollers.

4800 divisor.

DRIVEN WHEELS.

70 teeth wheel on stud.
56 teeth wheel on back rollers.

3920
9, or $1\frac{1}{8}$ inch diameter of front rollers.

48,00 { 12)352,80
4)29,4

7,35 total draught at slabbing frame.

What length of drawing will be required to supply a slabbing frame 1 day, (allowing it to work at the rate of 9 hours successively) having 40 spindles, and the back rollers traversing 62,367 inches per minute?

(See next page.)

62,367 inches, back rollers traverse per min.
40 spindles in frame.

2494,680
9 hours = 1 day.

22452,120
60 minutes = 1 hour.

36 in., 1 yard. { 6)1347127,200 inches of drawing required per day.
6)224521,2

37420,2 yards of drawing, or 44 hanks, 3 leas, $110\frac{1}{2}$ yards, required to supply a slabbing frame 9 hours, or 1 day

What time must a slabbing frame with 40 spindles work per day, to consume 1102054 inches of drawing, if it consumes 2494,68 inches per minute?

2494,68)1102054(441,76 minutes, or 7 hours, 21 minutes, 45 seconds, the slabbing frame must work to consume what the last head of drawings produces.
997872
1041820
997872
439480
249468
1900120
1746276
1538440
1496808
41632

If the front rollers of a slabbing frame traverse 458,4 inches per minute, and the diameter of the rollers be $1\frac{1}{8}$ inch, the number of spindles 40; what length of slabbing will it produce in 7 hours, 21 minutes, and 45 seconds, or 441,76 minutes.

(See next page.)

458,4 inches, rollers traverse per minute.
40 spindles in frame.

18336,0 slabbing frame produces per minute.
441,76 minutes, or 7 hours, 21¾ minutes.

110016
128352
18336
73344
73344

1 yd.=36 in. { 6)8100111,36 inches of slabbing produced in 7 hours, 21¾ minutes.
6)1350018,56

1 lea=120 yards)225003,0933 yards of slabbing produced in 7 hours, 21¾ minutes.

1 hank=7 leas)1875,02577 leas of slabbing produced in 7 hours, 21¾ minutes.

267,860822 hanks of slabbing produced in 7 7 leas, 1 hank. [hours, 21¾ minutes.

6,025755 leas.
120 yards, 1 lea.

3,090666 yds. or 267 hanks, 6 leas, 3 yds.

If 267 hanks, 6 leas, and 3 yards, or 267,8608 hanks of slabbing weighs 211½lbs.; what hank will it be?

RULE—Divide the number of hanks by the weight, and the quotient will be the hanks in one pound.

lbs. Hanks.
211,5)267,8608(1,266 hanks of slabbing in one pound.
2115

5636
4230

14060
12690

13708
12690

1018

If the 211½ lbs. of cotton had been carried through the different operations without waste, according to the foregoing doublings and draughts, it would have produced a slabbing equal to 1,266, or rather more than 1¼ hanks to the pound, but on trying the slabbing I find it to be equal to 1,5 hanks to the pound; what loss is sustained in working?

RULE—Divide the number of hanks produced by the hank slabbing, which, subtracted from the gross weight of cotton, say 211½lbs., will shew the loss sustained in working.

Hanks
Hank slabbing, 1,5)267,8608(178,574, or 178lbs., 9 oz. of slabbing
15 produced from 211½lbs. of cotton.

117
105

128
120

86
75

10
105

58
60—nearly

lbs.	oz.	
211..	8	gross weight of cotton fed on lap machine.
178..	9	net weight of slabbing produced.
32..	15	loss sustained in working. (Flies, strips, &c.)

TURNS PER INCH ON SLABBING.

The turns per inch on the slabbing, are required from the following particulars?

Revolutions of frame shaft per minute, 121,6.

Wheel on said shaft 90 teeth, working into wheel 138 teeth on stud, which works into wheel 46 teeth on shaft for driving spindles.

Wheel on shaft driving spindles, 50 teeth.

Wheel on spindles, 25 teeth.

Front rollers traverse 458,3987, or nearly 458,4 inches per minute.

N. B.—The wheel 138 *teeth is a carrying wheel; there is another wheel* 138 *teeth which is omitted, it being a carrier also.*

121,6 revolutions of frame shaft per minute.
90 teeth in wheel on said shaft.

10944,0
50 teeth wheel on spindle shaft.

547200 dividend.

46 teeth wheel (driven) on spindle shaft.
25 teeth wheel on spindles.

230
92

1150 divisor.

1150)547200(475,8 revolutions of spindles per minute.
4600

8720
8050

6700
5750

9500
9200

300

(Continued.)

Inches. Revolutions of Spindles.
458,3987)475,8260(1,038 turns per inch on slabbing.
4583987

17427300
13751961

36753390
36671896

81494

ROVING FRAME.

The speed of the first propelled shaft of the roving frame, is required from the following particulars?

Revolutions of shaft driving roving frame per minute, 143.
Diameter of drum on said shaft, 16 inches.
Diameter of pulley on frame shaft, 15 inches.

143 revolutions of shaft per minute.
16 inches diameter of drum on shaft

858
143

Diam. of pul. 15 in. { 5)2288,
3)457,6

152,533 revolutions of first propelled shaft at roving frame per minute.

The speed of the front rollers is required from the following particulars?
Revolutions of frame shaft per minute, 152,533.
Wheel on same shaft 54 teeth, working into carrying wheel 138 teeth, which works into wheel 70 teeth on front rollers.

152,533 revolutions of shaft per minute.
54 teeth wheel on said shaft.

610133
762666

teeth.
Whl. on front rol., 70)8236,800

117,66857 revolutions of front rollers per min.

If the front rollers of a roving frame make 117,66857 revolutions per minute, and their diameter be $1\frac{1}{8}$, or 1,125 inch; what will they traverse per minute?

117,6685 revols. of front rollers per minute.
1,125, or $1\frac{1}{8}$ inch diameter of do.

5883425
2353370
1176685
1176685

132,3770625
3,1416 circumference when diameter is 1.

7942623750
1323770625
5295082500
1323770625
3971311875

415,87577955000 inches, front roller traverses per minute.

The speed of the middle rollers is required, from the following particulars?

Revolutions of front rollers per minute, 117,6685.

Wheel on front rollers 24 teeth, working into wheel 70 teeth on stud; on same stud wheel 24 teeth, works into wheel 60 teeth on back rollers; wheel 30 teeth on the other end of back rollers, works into wheel 64 teeth on stud, which works into wheel 24 teeth on middle rollers.

117,6685 revols. of front rols. per min.
24 teeth wheel on do.

4706740
2353370

2824,0440
24 teeth wheel on stud.

11296176
5648088

67777,056
30 teeth wheel on back rollers.

2033311,680 dividend.

(Continued.)

70 teeth wheel on stud.
60 teeth wheel on back rollers.

4200
24 teeth wheel on middle rollers.

16800
8400

100800 divisor.

1008,00)20333,11,68(20,1717 revols. of mid. rols. per min.
2016

1731
1008

7231
7056

1756
1008

7488
7056

432

If the middle rollers be 1 inch diameter, making 20,1717 revolutions per minute; what will they traverse?

20,1717 revolutions of middle rollers per minute.
3,1416 circumference when diameter is 1.

1210302
201717
806868
201717
605151

63,37141272 inches, middle rollers trav. per minute.

The speed of the back rollers is required, from the following particulars?

Revolutions of front rollers per minute, 117,6685.

Wheel on front rollers 24 teeth, working into wheel 70 teeth on stud; on same stud wheel 24 teeth, works into wheel 60 teeth on back rollers.

117,6685 revolutions of front rollers per minute.
24 teeth wheel on do.

4706740
2353370

2824,0440
24 teeth wheel on stud.

11296176
5648088

67777,056 dividend.

70 teeth wheel on stud.
60 teeth wheel on back rollers.

4200 divisor.

42,00)677,77,056(16,137 revolutions of back rollers per minute.
42

257
252

57
42

157
126

310
294

16

If the back rollers be 1 inch diameter, making 16,137 revolutions per minute; what will they traverse?

16,137 revolutions of back rollers per minute.
3,1416 circumference when diameter is 1.

96822
16137
64548
16137
48411

50,6959992, or $50\frac{7}{10}$ inches nearly, back rollers traverse per minute.

The draught of roving frame is required from the following particulars?

Wheel on front rollers, 24 teeth, (driving.)
Wheel on stud, 70 teeth, (driven.)
Wheel on same stud, 24 teeth, (driving.)
Wheel on back rollers, 60 teeth, (driven.)
Diameter of back rollers, 1 inch, (driving.)
Diameter of front rollers, $1\frac{1}{8}$ inch, (driven.)

DRIVING WHEELS.

24 teeth wheel on front rollers.
24 teeth wheel on stud. (Change pinion.)

96
48

576
8=1 inch, diameter of back rollers.

4608 divisor.

DRIVEN WHEELS.

70 teeth wheel on stud.
60 teeth wheel on back rollers.

4200
9, or $1\frac{1}{8}$ inch, diameter of back rollers.

37800 dividend.

(Continued.)

4608)37800(8,203
36864

9360
9216

14400
13824

576

If the back rollers of a roving frame traverse 50,696 inches per minute, with 72 spindles; what length of slabbing will it consume, allowing the slabbing to be doubled, or 2 ends to each spindle?

50,696 inches, back rollers traverse per minute.
72 spindles in frame.

101392
354872

3650,112
2 slabbings to each spindle.

7300,224 inches, of slabbing consumed at roving frame per minute.

If 1 roving frame consumes 7300,224 inches of slabbing per minute; what time must 2 roving frames work, to consume 8100111,36 inches?

7300,224 inches, consumed per min. by 1 frame.
2 frames.

Divisor, 14600,448 inches, 2 frames consume per minute.

14600,448)8100111,36(554,78 minutes, or 9 hours, 14$\frac{3}{4}$ minutes, 2 roving frames must work successively, to consume what the slabbing frame produces.
73002240

79988736
73002240

69864960
58401792

114631680
102203136

124285440

124285440
116803584

7481856

What length of roving will 2 frames, of 72 spindles each, produce in 9 hours, $14\frac{3}{4}$ minutes, or 554,78 minutes, if the front rollers traverse 415,87 inches per minute?

415,87 inches front rollers traverse per minute.
72 spindles in 1 frame.

83174
291109

29942,64 inches of roving one frame prod. per min.
2 frames.

59885,28 inches of roving 2 frames prod. per min.
554,78 minutes, or 9 hours, $14\frac{3}{4}$ minutes.

47908224
41919696
23954112
29942640
29942640

33223155,6384 inches of roving the 2 frames produce in 554,78 minutes, or 9 hours $14\frac{3}{4}$ min.

How many hanks of roving are there in 33223155,6384 inches?

1 yard is 36 in. { 6)33223155,6384 inches of roving.
6)5537192,6064

1 hank is 840 yds.)922865,4344(1098,6493 hanks of roving.
840 — 7 leas 1 hank.

8286 — 4,5451 leas.
7560 — 120 yards 1 lea.

7265 — 65,4120 yards.
6720

5454 — 7834
5040 — 7560

143 — 2744
3360 — 2520

7834 — 224

33223155,6384 inches of roving will be 1098,6493 hanks, or 1098 hanks, 4 leas, and 65 yards.

If 1098 hanks, 4 leas, and 65 yards, or 1098,6493 hanks of roving weigh 211½lbs.; what hank will it be?

lbs. Hanks.
211,5)1098.6493(5,194 hanks roving.
10575

4114
2115

19999
19035

9643
8460

1183

N. B.—If the 211½lbs. of cotton could be carried through all the different operations in the card room to the roving without waste, it would produce a roving equal to 5,194 *hanks in the pound, (allowing the doublings and draughts to be the same, as shewn in former examples.)*

If, on trying the roving, its weight is equal to 6,15 hanks in the pound; what weight of roving will there be in 1098,649 hanks?

Hanks. Hanks yarn.
6,15)1098,649(178,64lbs. of roving.
615 16 oz. 1lb.

4836 384
4305 64

5314 10,24 oz
4920

3949
3690

2590
2460

130

Weight of cotton fed on lap machine, 211lbs. 8 oz.
Weight of roving produced, - - 178lbs. 10¼ oz.

Loss sustained in working, - - - 32lbs. 13¾ oz.

The speed of the spindles of roving frame, is required from the following particulars?

Revolutions of frame shaft per minute, 152,533.

Wheel on frame shaft 68 teeth, working into carrying wheel 138 teeth, which works into a wheel 52 teeth on spindle shaft; wheel 72 teeth on spindle shaft, works into wheel 18 teeth on spindle.

152,533 revolutions of frame shaft per minute.
68 teeth wheel on do.

1220266
915200

10372,266
72 teeth wheel on spindle shaft for driving spindles.

20744533
72605866

746803,200 dividend.

52 teeth wheel on spindle shaft.
18 teeth wheel on spindle.

416
52

936 divisor.

936)746803,2(797,86 revolutions of roving frame spindles per minute.
6552

9160
8424

7363
6552

8112
7488

6240
5616

624

The turns per inch of roving are required, from the following particulars?

Revolutions of spindles per minute, 797,86.
Front rollers traverse per minute, 316 inches.

316)797,86(2,525 turns per inch of roving.
632

1658
1580

786
632

1540
1580—nearly.

The speeds of any moving power belonging to machinery, may be found in the same manner as illustrated in the foregoing examples.

The construction of the slabbing and roving frames differs materially; every machine maker having a method of his own, whereoy to work the different moving powers, belonging to, and connected with, the slabbing and roving frames; while every master, manager, and overlooker, generally gives a preference to some particular machine maker.

Improvements in all kinds of machinery are continually progressing, but the system of calculations remains the same; therefore the system being well grounded, and on sure *data*, the improvements possible to be made will be the more easily arrived at, and while theory and practice are combined together, it will give both pleasure and satisfaction to the mind.

THROSTLE FRAME.

THROSTLES, like all other machinery, vary in construction either in one part or another, and while some persons prefer the patent throstles, of which there are several, others give the preference to the common throstle; but whatever the construction of the machine may be, any person having a thorough knowledge of calculations in addition to practice, will be enabled to form a proper estimate of machinery according to improvements and alterations made.

To produce regular yarns, it is very essential to have good washers; in place of round pieces of cloth, many prefer a strip of stout washer cloth, of a proper width, and length of the throstle, with holes, according to the number and distance of spindles. The washers being stationary, have more power on the bobbins, consequently, the yarns receive the twist more regularly.

The speed of the tin drum, or cylinder for driving spindles, is required from the following particulars?

Revolutions of shaft for driving throstles per minute, 153.

Diameter of drum on said shaft, 24 inches.

Diameter of pulley on tin drum, or cylinder shaft for driving spindles, 10 inches.

153 revols. of shaft per minute.
24 inches, diam. of drum on do.

612
306

Diameter of pulley, 10 in.)3672

367,2, or 367$\frac{1}{5}$ revolutions of tin drum, or cylinder for driving spindles per minute.

If the tin drum, or cylinder for driving spindles, makes 367,2 revolutions per minute; what number of revolutions will the spindles make, if the tin drum, or cylinder be 12 inches diameter, and the wharves 1 inch.

367,2 revols. of tin drum, or cylinder per min..
12 inches, diam. of do.

4406,4 revolutions of spindles per minute.

The revolutions per minute of the front rollers, are required from the following particulars?

Revolutions of pulley shaft per minute, 367,2.

Wheel on same shaft 32 teeth, working into large stud wheel 122 teeth; on same stud a wheel 40 teeth, works into carrying wheel 122 teeth, which works into wheel 54 teeth on front rollers.

367,2 revolutions of pulley shaft per minute.
32 teeth wheel on shaft.

7344
11016

11750,4
40 teeth wheel on stud.

470016,0 dividend.

122 teeth wheel on stud.
54 teeth wheel on end of front rollers.

488
610

6588 divisor.

6588)470016(71,344 revols. of front rols. per min.
46116

8856
6588

22680
19764

29160
26352

28080
26352

1728

If the front rollers of a throstle make 71,344 revolutions per minute; what will they traverse if they be 1 inch diameter?

71,344 revolutions of front rollers per min.
3,1416 circumference when diameter is 1.

428064
71344
285376
71344
214032

224,1343104 rather more than 224$\frac{1}{8}$ inches, front rollers traverse per minute.

If the front rollers of a throstle traverse, or deliver 224,134 inches per minute; how many hanks per spindle will be produced in 1 week, if the throstle works successively 60 hours, thus allowing 9 hours for doffing and other stoppages?

224,134 inches, front rollers deliver per min.
60 minutes, 1 hour.

13448,040
60 hours, 1 week.

6)806882,400 inches produced per spindle per week.
6)134480,4

36 inches, 1 yard.

1 lea is 12,0 yds.)2241,3,4 yards produced per week.

1 hank is 7 leas.)186,77833 leas produced per week.

26,682619 hanks produced per week.
7 leas 1 hank.

4,778333 leas.
120 yards 1 lea.

93,340000 yards.

The length produced per spindle in 60 hours, or 1 week, will be 26 hanks, 4 leas, and 93,$\frac{4}{6}$ yards.

The speed of the middle rollers is required from the following particulars?

Revolutions of front rollers per minute, 71,344.

Wheel on front rollers 20 teeth, working into stud wheel 90 teeth; on the same stud, change wheel 23 teeth, works into wheel 46 teeth on back rollers; on the other end of back rollers there is a wheel 25 teeth, working into carrying wheel 36 teeth on stud, which works into wheel 19 teeth on middle rollers.

71,344 revolutions of front rollers per minute.
20 teeth wheel on do.

1426,880
23 teeth wheel. (Change pinion.)

4280640
2853760

32818,240
25 teeth wheel on back rollers.

16409120
6563648

820456,00 dividend.

90 teeth wheel on stud.
46 teeth wheel on back rollers.

4140
19 teeth wheel on middle rollers.

37260
4140

78660 divisor.

78660)820456(10,43 revolutions of middle rollers per minute.
78660

338560
314640

239200
235980

3220

If the middle rollers of a throstle be ¾ inch diameter, making 10,43 revolutions per minute; what will they traverse?

10,43 revolutions of middle rollers per min.
,75, or ¾ inch diameter of do.

5215
7301

7,8225
3,1416 circumference when diameter is 1.

469350
78225
312900
78225
234675

24,57516600, or rather more than 24½ inches, middle rollers traverse per minute.

The speed of the back rollers of a throstle, is required from the following particulars?

Revolutions of front rollers per minute, 71,344.

Wheel on front rollers 20 teeth, working into large stud wheel 90 teeth; small stud wheel, or change pinion 23 teeth, working into wheel 46 teeth on back rollers.

71,344 revolutions of front rollers per min.
20 teeth wheel on do.

1426,880
23 teeth wheel change pinion.

428064
285376

32818,24 dividend.

90 teeth wheel on stud.
46 teeth wheel on back rollers.

4140 divisor.

(Continued.)

4140)32818,24(7,927 revolutions of back rollers per minute.
28980

38382
37260

11224
8280

29440
28980

460

If the back rollers of a throstle be $\frac{7}{8}$ inch diameter, making 7,927 revolutions per minute; what will they traverse?

7,927 revols. of back rollers per minute.
875, or $\frac{7}{8}$ inch diameter of do.

39635
55489
63416

6,936125
3,1416 circumference when diameter is 1.

41616750
6936125
27744500
6936125
20808375

21,7905303000, or rather more than 21¾ inches, back rollers traverse per min.

If the back rollers of a throstle traverse 21,79 inches per minute, and the middle rollers 24,575 inches; what draught will there be?

21,79)24,575166(1,128 draught between back and middle rollers.
2179

2785
2179

6061
4358

17036
17432—nearly.

If the middle rollers of a throstle traverse 24,575166 inches per minute, and the front rollers 224,13431; what draught will there be between the middle and front rollers?

24,575)224,13431(9,12 draught between middle and front rollers.
221175

29593
24575

50181
49150

1031

If the back rollers of a throstle traverse 21,79 inches per minute, and the front rollers 224,1343; what draught will there be between the front and back rollers?

21,79)224,1343(10,286 draught between the back and front rollers.
2179

6234
4358

18763
17432

13310
13074

236

If the driving wheels be 20 and 23, and the driven wheels 90 and 46, the diameter of the front rollers 1 inch, and the back rollers $\frac{7}{8}$ inch; what draught will there be?

DRIVING WHEELS.
20
23

460
Back roller $\frac{7}{8}$ inch, or 7

3220 divisor.

Continued.)

DRIVEN WHEELS.

90
46

4140
8=1 inch front rollers.

3220)33120(10,286 nearly, draught in rollers.
3220

9200
6440

27600
25760

18400
19320—nearly.

If one spindle produces 26 hanks, 4 leas, and 93$\frac{4}{10}$ yards, or 26,682622 hanks of twist per week; what length and weight of No. 30's twist will 6876 spindles produce?

26,682622 hanks per spindle per week.
6876 spindles.

160095733
186778355
213460977
160095733

No. of twist, 3,0's)18346,9,709988 hanks of twist per week.

6115,6569996 lbs. of twist per week.
16 ounces 1 lb.

39419976
6569996

10,5119936 ounces.
4 qrs. 1 oz.

2,0479744

Length of twist produced, 18346,97, nearly 18347 hanks.
Weight of twist produced, 6115 lbs., 10½ oz. of No. 30's twist.

The speed of the mangle wheel is required, from the following particulars?

Revolutions of pulley shaft per minute, 367,2.

Wheel on said shaft 32 teeth, working into stud wheel 122 teeth; wheel on same stud 6 teeth, working into wheel 110 teeth on mangle wheel shaft; wheel 8 teeth on mangle wheel shaft, working into mangle wheel 82 teeth.

122 teeth wheel on stud.
110 teeth wheel on mangle wheel shaft.

13420
82 teeth mangle wheel.

26840
107360

1100440 divisor.

367,2 revolutions of pulley shaft per minute.
32 teeth wheel on do.

7344
11016

11750,4
6 teeth wheel on stud.

70502,4
8 teeth wheel on mangle wheel shaft.

1100440)564019,2(,512539, or rather more than half a revolution of mangle wheel per minute.
5502200

1379920
1100440

2794800
2200880

5939200
5502200

4370000
3301320

10686800
9903960

782840

The speed of the traverse shaft is required, from the following particulars?

Revolution of mangle wheel per minute, ,512539.

Wheel on mangle wheel 21 teeth working racks, which works into wheel 43 teeth on traverse shaft.

,51254 revolution of mangle wheel per min.
21 teeth on mangle wheel, working racks.

51254
102508

teeth.
Whl. on trav. shaft, 43)10,76334(,25, or rather more than ¼ of a revolution of traverse shaft per minute.
86

216
215

1

What will the traverse move per minute, according to the following particulars?

Revolution of traverse shaft per minute, ,25, or ¼.
Diameter of pulleys on traverse shaft, 1½ inch.

3,1416 circumference when diameter is 1.
1,5, or 1½ inch diameter of pulleys on traverse shaft.

157080
31416

4,71240
,25 or ¼ revolution of traverse shaft.

235620
94248

1,178100, or rather more than $1\frac{1}{6}$ inch, traverse moves per minute.

If the front rollers of a throstle traverse, or deliver 224,135 inches per minute, and the spindles make 4406,4 revolutions per minute; how many turns will there be in 1 inch of twist?

Deliv. per min., 224,135 in.)4406,400(19,65958 turns per inch for No. 30's twist.

224135

2165050
2017215

1478350
1344810

1335400
1120675

2147250
2017215

1800350
1120675

1796750
1793080

3670

PARTICULARS OF A THROSTLE FRAME.

Revolutions of a tin drum, or cylinder for driving spindles per minute, 367,2.

Revolutions of spindles per minute, 4406,4.

Revolutions of front rollers per minute, 71,34426.

Revolutions of middle rollers per minute, 10,4304.

Revolutions of back rollers per minute, 7,927.

Revolution of mangle wheel per minute, 0,51254.

Revolution of traverse shaft per minute, 0,25.

Diameter of pulleys on drum, or cylinder shaft, 10 inches.

Diameter of drum, or cylinder driving spindles, 12 inches.

Diameter of wharves, 1 inch.

Diameter of front rollers, 1 inch.

Diameter of middle rollers, $\frac{3}{4}$ inch.

Diameter of pulleys on traverse shaft, $1\frac{1}{2}$ inch.

Front rollers traverse, or deliver per minute, 224,134 inches.-

Middle rollers traverse per minute, 24,57 inches.

Back rollers traverse, or consume per minute, 21,79 inches.

Traverse, or bobbin rail moves per minute, 1,17956 inches.

Draught between back and middle rollers, 1,2878 nearly.

Draught between middle and front rollers, 9,12.

Total draught in rollers, 10,286.

Turns per inch for 30's twist, 19,659, or $19\frac{2}{3}$ nearly.

Hanks per spindle produced, 26 hanks, 4 leas, and $93\frac{4}{10}$ yards per week of 60 hours.

MULES.

The speed of the rim shaft is required from the following particulars ?

Revolutions of shaft for driving upright shaft in wheel house, 86.

Diameter of drum on said shaft, 25 inches.

Diameter of pulley on upright shaft in wheel house, 12 inches.

Wheel on foot of upright shaft in wheel house 68 teeth, working into wheel 45 teeth on rim shaft.

86 revolutions of shaft per minute.
25 inches diameter of drum on shaft.

430
172

2150
68 teeth wheel on foot of upright shaft in wheel house.

17200
12900

146200 dividend.

12 inches diameter of pulley on upright shaft in wheel house.
45 teeth wheel on rim shaft.

540 divisor.

(Continued.)

54,0)14620,0(270,74 revolutions of rim shaft per minute.
108
382
378
400
378
220
216
4

Or thus, which is preferable when it can be divided by component parts.

54,0 { 6)14620,0
9)2436,66

270,74 revolutions of rim shaft per minute.

The speed of the front rollers is required, from the following particulars?

Revolutions of rim shaft per minute, 270,74.

Wheel on rim shaft 50 teeth, working into wheel 64 teeth on top of long driver shaft; wheel on bottom of long driver shaft 40 teeth, working into wheel 80 teeth on front rollers.

270,74 revolutions of shaft per minute.
50 teeth wheel on do.

13537,00
40 teeth wheel on bottom of long driver.

541480 dividend.

64 teeth wheel on top of long driver.
80 teeth wheel on front rollers.

5120 divisor.

(Continued.)

[illegible] 105.75 revolutions of front rollers
[illegible] per minute.

[illegible]

If the front rollers be 1 inch diameter, making 105.75 revolutions per minute; what will they traverse?

105.75 revolutions of front rollers per minute.
3.1416 circumference when diameter is 1.

63450
10575
42300
10575
31725

332,224200, or 332¼ inches, front rollers traverse per minute.

The speed of the middle rollers is required, from the following particulars?

Revolutions of front rollers per minute, 105,75

Wheel on front rollers 24 teeth, working into wheel 100 teeth on shaft for driving back rollers; wheel on shaft for driving back rollers 25 teeth, working into wheel 50 teeth on back rollers; wheel on back rollers 24 teeth, working into carrying wheel 40 teeth on stud, which works into wheel 21 teeth on middle rollers.

(See next page.)

105,75 revolutions of front rollers per minute.
24 teeth wheel on do.

42300
21150

2538,00
25 teeth wheel, (change pinion,) on shaft driving back rollers.

12690
5076

63450
24 teeth wheel on back rollers.

253800
126900

1522800 dividend.

100 teeth wheel on shaft driving back rollers.
50 teeth wheel on back rollers.

5000
21 teeth wheel on middle rollers.

105000 divisor.

105,000)1522,800(14,5 revolutions of middle rollers per minute.
105

472
420

528
525

3

If the middle rollers be $\frac{7}{8}$ inch diameter, making $14\frac{1}{2}$ revolutions per minute; what will they traverse?

14,5 revolutions of middle rollers per minute.
,875, or $\frac{7}{8}$ inch diameter of rollers.

725
1015
1160

12,6875
3,1416 circumference when diameter is 1.

761250
126875
507500
126875
380625

39,85905000 inches, middle rollers traverse per minute.

The speed of the back rollers is required, from the following particulars?

Revolutions of middle rollers per minute, 14,5 inches.

Wheel on middle roller 21 teeth, working into carrying wheel 40 teeth on stud, which works into wheel 24 teeth on back rollers.

14,5 revolutions of middle rollers per minute.
21 teeth wheel on do.

145
290

teeth.
Whl. on mid. rols. 24)304,5(12,6875 revolutions of back rollers per minute.
24

64
48

165
144

210
192

180
168

120
120

If the back rollers be $\frac{7}{8}$ inch diameter, making 12,6875 revolutions per minute; what will they traverse?

12,6875 revolutions of back rollers, per min.
,875, or $\frac{7}{8}$ inch diameter of rollers.

634375
888125
1015000

11,1015625
3,1416 circumference when diameter is 1.

666093750
111015625
444062500
111015625
333046875

34,87666875000, or $34\frac{7}{8}$ inches, back rollers traverse per minute.

The draught between the back and middle rollers, is required from the following particulars?

Middle rollers traverse per minute, 39,859.

Back rollers traverse per minute, 34,876.

34,876)39,859(1,14288 draught between back and middle rollers.
34876

49830
34876

149540
139504

100360
69752

306080
279008

270720
279008—nearly.

The draught between the front and middle rollers, is required from the following particulars?

Front rollers traverse per minute, 332,2242 inches.

Middle rollers traverse per minute, 39,859 inches.

39,859)332,2242(8,3349 draught between front and mid. rols.
318872

133522
119577

139450
119577

198730
159436

392940
358731

34209

The draught between the front and back rollers, is required from the following particulars?

Front rollers traverse per minute, 332,2242 inches.

Back rollers traverse per minute, 34,8766 inches.

34,8766)332,2242(9,525 draught between back and front rollers.
3138894

1833480
1743830

896500
697532

1989680
1743830

245850

The draught in rollers at mules, is required from the following particulars?

Wheel on front rollers 24 teeth, working into wheel 100 teeth on shaft for driving back rollers; change wheel 25 teeth on same shaft, works into wheel 50 teeth on back rollers.

Diameter of back rollers, $\frac{7}{8}$ inch.

Diameter of front rollers, 1 inch.

DRIVING WHEELS.

24 teeth wheel on front roller.
25 teeth wheel, or change pinion.

120
48

600
,875, or $\frac{7}{8}$ inch diameter of back rollers.

525,000 divisor.

DRIVEN WHEELS.

100 teeth wheel on shaft for driving back rollers.
50 teeth wheel on do.

5000
1 inch diameter of front rollers.

5000 dividend.

525)5000(9,524 draught between back and front rollers.
4725

2750
2625

1250
1050

2000
2100—nearly.

N. B.—The small difference between this and the last example, arises from the decimal fractions, which occur in the other system of working.

If the front rollers deliver 55 inches each stretch, which puts up 60 inches; the gain or draught in the carriage will be 5 inches, which is equal to $1\frac{1}{12}$ draught; the draught in the rollers is 9,524; what will the total draught be?

9,524 draught in rollers.
60 inches length of stretch.

Delivd. from rols. 55 in. { 5)571,440 / 11)114,288

10,3899, or $10\frac{38}{100}$ (nearly), total draught at mules.

If the total draught at mules be 10,39, and the numbers to be spun 40's; the length required to be spun 20 hanks per spindle per week, the number of spindles in the mules 1000; what hank roving will be required, what number of hanks, and what weight?

RULE.—Multiply the number of spindles in the mules, by the number of hanks required per spindle, and the product will be the total number of hanks of yarn produced per week; which, divided by the draught, will give the number of hanks of roving required. Then divide the numbers of yarn by the draught in the mules, and the quotient will be the hank roving. Then divide the number of hanks of roving required to produce the given length of yarn, by the hank roving, and the quotient will be the weight of roving required.

EXAMPLE.

1000 number of spindles in mules.
20 hanks, length required per spindle.

20000 total number of hanks.

Hanks.
Draught 10,39)20000(1925 nearly, hanks of roving required.
1039
9610
9351
2590
2078
5120
5195—nearly.

(*Continued.*)

Nos. of yarn.
Draught 10,39)40,00(3,85 hank roving required.
3117

8830
8312

5180
5195—nearly.

Hanks.
Hank roving, 3,85)1925(500lbs. net weight of roving required.
1925

The speed of the scroll is required, from the following particulars?

Revolutions of rim shaft per minute, 270,74.

Wheel on rim shaft 20 teeth, working into wheel 60 teeth on short driving shaft.

Wheel on bottom end of short driving shaft, 32 teeth, working into wheel 100 teeth on scroll shaft.

270,74 revolutions of rim shaft per min.
20 teeth wheel on do.

5414,80
32 teeth wheel on bottom end of short driver.

108296
162444

173273,6 dividend.

60 teeth wheel on top of short driver.
100 teeth wheel on scroll shaft.

6000 divisor.

6,000)173,273,6

28,879 nearly, revols. of scroll shaft per min.

If the scroll makes 28,879 revolutions per minute, and be 4 inches diameter; what will it traverse?

28,879 revolutions of scroll per minute.
4 inches, diameter of do.

115,516
3,1416 circumference when diameter is 1.

693096
115516
462064
115516
346548

362,9050656 nearly 363 inches, scroll trav. per min.

The gain, or draught in carriage, is required from the following particulars?

Scroll traverses per minute, 362,9050656 inches.

Front rollers traverse per minute, 332,2242 inches.

332,2242)362,9050656(1,09235 gain, or draught in carriage.
3322242

30680865
29900178

7806876
6644484

11623920
9966726

16571940
16611210—nearly.

By multiplying the draught in rollers, by the draught, or gain in carriage, it will give the total draught at mules.

If the length of the stretch be 61 inches, and the gain, or draught in carriage be 1,09235; what length will the rollers deliver, and how many inches will the carriage gain per stretch?

Inches stretch.

Draught at carriage, 1,09235)61,00000(55,8429 inches, delivered at rollers per minute.

546175

638250
546175

920750
873880

468700
436940

317600
218470

991300
983115

8185

61,0000 inches, length of stretch.
55,8429 inches, delivered at rollers.

5,1571 inches, carriage gains.

The speed of the spindles at mules, is required from the following particulars?

Revolutions of rim shaft per minute, 270,74.
Diameter of rim, 23¼ inches.
Diameter of rim band pulley, 18¼ inches.
Diameter of twist pulley, 14¼ inches.
Diameter of drums in carriage, 10 inches.
Diameter of wharves, ¾ inch.

(See next page.)

[illegible] revolutions of rim per minute.
[illegible] inches, diameter of rim.

[illegible]
[illegible]
[illegible]
[illegible]

[illegible]
[illegible] inches, diameter of twist pulley.

[illegible]
[illegible]
[illegible]
[illegible]

[illegible] dividend.

1 25 inches, diameter of rim band pulley.
,75, or ¾ inch, diameter of wharves.

9:25
12775

12,6875 divisor.

12,687)[illegible],54625(65,536 revolutions of spindles
82122 at mules per minute.

75775
63435

73404
63435

49696
41061

86352
82122

4230

If the scroll at a pair of mules traverse at the rate of 363 inches per minute, and the spindles make 6553 revolutions; how many turns per inch will there be in the yarn?

363)6553(18,05 turns per inch in yarn, while carriage is coming out.
363

2923
2904

1900
1815

85

How many turns will the rim make per stretch, if the front rollers deliver 57 inches, allowing the rim to make 271 revolutions, while the front rollers deliver 332,224 inches?

RULE.—Multiply the revolutions of the rim by the length of the stretch, and divide by the number of inches delivered at the front rollers, and the quotient will be the revolutions, or turns of rim per stretch.

271 revolutions of rim.
57 inches length of stretch.

1897
1355

Inches delivered, 332,224)15447,000(46,4957 revolutions, or turns of rim per stretch.
1328896

2158040
1993344

1646960
1328896

3180640
2990016

1906240
1661120

2451200
2325568

125632

To find the number of turns required for twist, or weft per inch.

RULE.—For twist, multiply the square root of the numbers, or counts of yarn by 3,75, or $3\frac{3}{4}$, and for weft, multiply the square root of the numbers, or counts of yarn by 3,25, or $3\frac{1}{4}$, and the products will be the turns per inch required.

What number of turns per inch will 44's twist require, according to the foregoing rule?

COUNTS.

44(6,633 square root of 44.
36

126)800
756

1323)4400
3969

13263)43100
39789

3311

6,633 square root of 44.
3,75, or $3\frac{3}{4}$

33165
46431
19899

24,87375, or nearly 25 turns per inch, required for No. 44's twist.

What number of turns per inch will 36's weft require?

6 is the square root of 36.
3,25

19,50, or $19\frac{1}{2}$ turns per inch required for 36's weft.

What number of turns per inch will 100's twist require?

10 is the square root of 100.
3,75

37,50, or $37\frac{1}{2}$ turns per inch required for No. 100's twist.

The preceding rules for ascertaining the turns per inch required for twist and weft, have been generally adopted; however, where a good, or even a fair quality of cotton is used, the following rule will be found to answer, particularly for some qualities of yarns.

RULE.—Multiply the numbers, or counts of yarn by 12, the square root of which gives the turns per inch required for twist. Weft will require $3\frac{1}{2}$, or 4 turns per inch less than twist.

N. B.—Some cotton requires more twist than others, according to its quality.

What number of turns per inch will be required for No. 50's twist, or weft, according to the above rule?

50's numbers, or counts of yarn.
12

600(25 turns nearly, required for 50's twist, less
4 $3\frac{1}{2}$ turns for weft.

45)200
225—nearly.

What number of turns per inch will be required for 100's twist, or weft?

100's numbers, or counts of yarn.
12

1200(34,64 turns per inch required for No. 100's
9 twist, less $3\frac{1}{2}$ turns, which will be
equal to 31,14 turns per inch for 100's
64)300 weft.
256

686\4400
4116

6924)28400
27696

704

RULE for ascertaining the revolutions of spindles, for the rim 1.—Multiply the diameters of the driving pulleys together for a dividend, and the driven pulleys accordingly for a divisor, and the quotient will be the revolutions of the spindles for the rim 1.

If the rim and rim band pulleys be each 22 inches diameter, the twist pulley 13½ inches, and the wharves ⅞ inch; what revolutions or turns will the spindles make for the rim 1?

N. B.—The rim and rim band pulley being of the same diameters are omitted in the working.

Diameter of wharves, ,875)13,500(15,428 revolutions of spindles for rim 1.

875

4750
4375

3750
3500

2500
1750

7500
7000

500

If the rim be 33 inches diameter, the rim band pulley 26 inches, the twist pulley 14¼ inches, and the wharves ¾ of an inch; what number of revolutions, or turns will the spindles make for the rim 1?

DRIVERS.

Twist pulley, 14,25 inches.
Rim, 33 inches.

4275
4275

470,25 dividend.

(Continued.)

DRIVEN.

26 inches drum band pulley.
,75, or $\frac{3}{4}$ inch wharves.

130
182

19,50 divisor.

195,)470,25(24,115 revolutions of spindles for rim 1.
390

802
780

225
195

300
195

1050
975

75

BELL WHEEL, OR REVOLUTIONS OF RIM PER STRETCH.

RULE.—Multiply the turns required per inch, by the number of inches in the length of the stretch, for a dividend, and divide by the revolutions, or turns the spindles make for the rim 1, and the quotient will be the number of teeth for the bell wheel, or revolutions of rim per stretch.

If 18,62 turns per inch be required, and the length of the stretch be 58 inches, the revolutions or turns of spindles 15,428 for the rim 1; what number of teeth must there be in the bell wheel, or what revolutions must the rim make per stretch?

18,62 turns required per inch.
58 inches, length of stretch.

14896
9310

15,428)1079,96(70 teeth required for bell wheel, or revolutions of rim per stretch.
107996

The turns per inch are required from the following particulars?

Bell wheel, 70 teeth; rim, 22 inches diameter; rim band pulley, 22 inches diameter; twist pulley, 13½ inches diameter; drums in carriage, 10 inches diameter; wharves, ⅞, or ,875 inch diameter, and length of stretch, 58 inches.

N. B.—The rim, rim band, pulley, and drum in carriage are omitted, on account of being drivers and driven of the same dimensions.

Multiply the number of teeth in the bell wheel, by the diameters of the driving pulleys respectively for a dividend; then multiply the number of inches in the length of a stretch, by the diameters of the driven pulleys accordingly for a divisor, and the quotient will be the revolutions or turns per inch.

58 inches, length of stretch.
,875, or ⅞ inch, diameter of wharves.

7000
4375

50,750 divisor.

13,5, or 13½ inches, diameter of twist pulley.
70 teeth bell wheel, or revols. of rim per stretch.

50,75)94,5000(18,62 turns per inch.
5075

43750
40600

31500
30450

10500
10150

350

If 26 turns per inch be required, and the length of the stretch be 61 inches; the revolutions, or turns of the spindles 24,115 for the rim 1; what number of teeth must there be in the bell wheel, or what revolutions must the rim make per stretch?

26 turns per inch.
61 inches, length of stretch.

26
156

24,115)1586,000(65,768, or nearly 66 teeth required
144690 for bell wheel, or revolutions
of rim per stretch.
139100
120575
185250
168805
164450
144690
197600
192920
4680

The turns per inch are required from the following particulars? Bell wheel, 66 teeth; length of stretch, 60 inches; diameter of rim, 33 inches; diameter of rim band pulley, 26 inches; diameter of twist pulley, 14¼ inches; diameter of drums in carriage, 10 inches, and diameter of wharves, ¾ inch.

66 teeth bell wheel.
33 inches, diameter of rim.

198
198
2178
14,25, or 14¼ inches, diameter of twist pulley.
10890
4356
8712
2178

31036,50 dividend. *(Continued.)*

26 inches, diameter of twist pulley.
60 inches, length of stretch.

1560
,75, or $\frac{3}{4}$ inch, diameter of wharves.

7800
10920

1170,00 divisor.

1170,)31036,5(26,52 turns per inch required.
2340

7636
7020

6165
5850

3150
2340

810

Whatever the principle of the mules is, any particular may be found by attending to the rules and examples illustrated.

N. B.—The general rules are exemplified with the different tables, and will appear in their regular course.

TABLES.

SHEWING the size, hank, and proportion of hank in every operation, from the lap machine through all the various processes of carding, drawing, slabbing, roving and spinning, with practical rules and examples.

EXPLANATION OF THE CARDING AND DRAWING TABLES.

The first line in the carding and drawing table, is the decimal of the hank according to its length and weight, which will be found in the following manner:—Multiply all the draughts together as far as regards the operation you intend trying, whether it be slabbing, drawing, or carding, for a dividend, and all the doubling accordingly for a divisor, the quotient will be the draught; then divide the numbers you are spinning, or the numbers you wish to spin, by the net draught, and the quotient will be the decimal of the hank; opposite to which in the table, you will have the weight according to the length weighed.

EXAMPLE.

Suppose the total draught to be 181440, the doubling 1728, and the numbers to be spun 40's; what weight will 2 yards of carding, or doubling be?

1728)181440(105 draught more than doubling.
1728

8640
8640

Counts.
Draught more than doubling 105)40,0(0,38 decimal of a hank. Opposite to which in the table under 2 yards will be found, 1 dwt. 19,8 grains, the weight required.
315

850
840

10

CARDING AND DRAWING TABLE.

From ,05 to ,089 decimal of hank for 2, 4, and 6 yards.

Dec. of	2 yards.		Dec. of	4 yards.			Dec. of	6 yards.		
Hank.	dwts.	grains.	hank.	oz	dwts.	grains.	hank.	oz	dwts	grns.
,05	13	21,38	,05	1	9	13,16	,05	2	5	5.
,051	13	14,78	,051	1	9	0,06	,051	2	4	9,35
,052	13	8,51	,052	1	8	11,52	,052	2	3	14,53
,053	13	2,46	,053	1	7	23,43	,053	2	2	20,39
,054	12	20,64	,054	1	7	11,78	,054	2	2	2,92
,055	12	15,03	,055	1	7	0,56	,055	2	1	10,09
,056	12	9,61	,056	1	6	13,73	,056	2	0	17,85
,057	12	4,39	,057	1	6	3,29	,057	2	0	2,18
,058	11	23,35	,058	1	5	17,21	,058	1	17	16,56
,059	11	18,48	,059	1	5	7,47	,059	1	17	1,95
,06	11	13,77	,06	1	4	22,05	,06	1	16	11,83
,061	11	9,22	,061	1	4	12,94	,061	1	15	22,17
,062	11	4,81	,062	1	4	4,13	,062	1	15	8,95
,063	11	0,55	,063	1	3	19,6	,063	1	14	20,15
,064	11	20,41	,064	1	3	11,33	,064	1	14	7,74
,065	10	16,41	,065	1	3	3,32	,065	1	13	19,73
,066	10	12,52	,066	1	2	19,55	,066	1	13	8,07
,067	10	8,75	,067	1	2	12,01	,067	1	12	20,76
,068	10	5,09	,068	1	2	4,69	,068	1	12	9,79
,069	10	1,45	,069	1	1	21,41	,069	1	11	22,87
,07	9	22,09	,07	1	1	14,69	,07	1	11	12,5
,071	9	18,74	,071	1	1	7,98	,071	1	11	2,72
,072	9	15,89	,072	1	1	2,29	,072	1	10	18,19
,073	9	12,31	,073	1	0	19,12	,073	1	10	7,48
,074	9	9,22	,074	1	0	12,95	,074	1	9	22,17
,075	9	6,22	,075	1	0	6,94	,075	1	9	13,21
,076	9	3,29	,076	1	0	1,1	,076	1	9	4,39
,077	9	0,45	,077		18	0,9	,077	1	8	19,85
,078	8	21,67	,078		17	19,35	,078	1	8	11,52
,079	8	18,97	,079		17	13,94	,079	1	8	3,41
,08	8	16,33	,08		17	8,66	,08	1	7	19.5
,081	8	13,76	,081		17	3,52	,081	1	7	11,78
,082	8	11,25	,082		16	22,5	,082	1	7	4,25
,083	8	8,8	,083		16	17,6	,083	1	6	20,9
,084	8	6,41	,084		16	12,82	,084	1	6	13,37
,085	8	4,07	,085		16	8,15	,085	1	6	6,73
,086	8	1,79	,086		16	3,59	,086	1	5	23,89
,087	7	23,57	,087		15	23,14	,087	1	5	17,21
,088	7	21,39	,088		15	18,78	,088	1	5	10,68
,089	7	19,26	,089		15	14,53	,089	1	5	4.29

What will 8 yards of ,08, or $\frac{8}{100}$ hank weigh ?

Proportion of hank, ,08)66,66

No. of grains in 1 oz., 437,5)833,33 grains.(1 oz.
437,5

1 dwt. is 24 grains.)395,83(16 dwts.
24

155
144

11,83 grains.

Weight of 8 yards of ,08 decimal of hank drawing, will be 1 oz., 16 dwts., 11,83 grains.

If 8 yards of drawing weigh 1 oz., 16 dwts., 11,83 grains what size or proportion of hank will it be ?

1 ounce 437,5 grains.
16 dwts. x 24 grains 384, grains.
11,833 grains.

1 oz., 16 dwts., 11,83 grains, 833,333

The dividend for 8 yards is 66,666.

833,33)66,6666(,08 decimal of a hank, or size of drawing.
666666

What will 6 yards of ,1, or $\frac{1}{10}$ hank drawing weigh ?

Dividend for 6 yards is 50. (See table of dividends.)

0,1)50,

500 grains weight.

1 ounce, 437,5 grains.)500,0(1 oz.
437,5

1 dwt. is 24 grains.)62,5(2 dwts.
48

14,5 grains.

Weight of 6 yards of 0,1, or $\frac{1}{10}$ hank drawing, will weigh 1 oz., 2 dwts., 14$\frac{1}{2}$ grains.

CARDING AND DRAWING TABLE.

From ,09 to ,129 decimal of hank for 2, 4, and 6 yards.

Dec. of	2 yards.		Dec. of	4 yards.			Dec. of	6 yards.		
Hank.	dwts	grains.	hank.	oz	dwts	grains.	hank.	oz	dwts	grns.
,09	7	17,18	,09		15	10,37	,09	1	4	22,05
,091	7	15,15	,091		15	6,3	,091	1	4	15,95
,092	7	13,15	,092		15	2,31	,092	1	4	9,97
,093	7	11,21	,093		14	22,42	,093	1	4	4,13
,094	7	9,3	,094		14	18,6	,094	1	3	22,41
,095	7	7,43	,095		14	14,87	,095	1	3	16,81
,096	7	5,61	,096		14	11,22	,096	1	3	11,33
,097	7	3,82	,097		14	7,64	,097	1	3	5,96
,098	7	2,06	,098		14	4,13	,098	1	3	0,7
,099	7	0,35	,099		14	0,7	,099	1	2	19,55
,1	6	22,66	,1		13	21,33	,1	1	2	14,5
,101	6	21,01	,101		13	18,03	,101	1	2	9,05
,102	6	19,39	,102		13	14,79	,102	1	2	4,69
,103	6	17,81	,103		13	11,62	,103	1	1	23,93
,104	6	16,25	,104		13	8,51	,104	1	1	19,26
,105	6	14,72	,105		13	5,46	,105	1	1	14,68
,106	6	13,13	,106		13	2,27	,106	1	1	9,91
,107	6	11,76	,107		12	23,52	,107	1	1	5,78
,108	6	10,32	,108		12	20,64	,108	1	1	1,46
,109	6	8,9	,109		12	17,81	,109	1	0	21,21
,11	6	7,51	,11		12	15,03	,11	1	0	17,04
,111	6	6,15	,111		12	12,3	,111	1	0	12,95
,112	6	4,98	,112		12	9,97	,112	1	0	9,46
,113	6	3,49	,113		12	6,98	,113	1	0	4,97
,114	6	2,19	,114		12	4,39	,114	1	0	1,09
,115	6	0,92	,115		12	1,85	,115		18	2,78
,116	5	23,67	,116		11	23,35	,116		17	23,03
,117	5	22,45	,117		11	20,9	,117		17	19,35
,118	5	21,24	,118		11	18,48	,118		17	15,72
,119	5	20,05	,119		11	16,11	,119		17	12,16
,12	5	18,88	,12		11	13,77	,12		17	8,66
,121	5	17,74	,121		11	11,48	,121		17	5,22
,122	5	16,61	,122		11	9,22	,122		17	1,83
,123	5	15,5	,123		11	7,	,123		16	22,5
,124	5	14,4	,124		11	4,81	,124		16	19,22
,125	5	13,33	,125		11	2,66	,125		16	16,
,126	5	12,27	,126		11	0,5	,126		16	12,82
,127	5	11,23	,127		10	22,46	,127		16	9,7
,128	5	10,2	,128		10	20,41	,128		16	6,62
,129	5	9,19	,129		10	18,39	,129		16	3,59

The following will be the dividends, according to the number of yards for ascertaining the weight of any decimal part of a hank.

Yards.	Dividends.
1	8,333
2	16,666
3	25,
4	33,333
5	41,666
6	50,
7	58,333
8	66,666
9	75,
10	83,333
15	125,
20	166,
30	250,
40	333,333
60	500,
80	666,666
120	1000.

RULE.—Divide the dividend by the hank, or decimal part of a hank, according to the number of yards weighed, and the quotient will be the weight in grains.

What will 2 yards of 0,13 of a hank weigh?

Dividend for 2 yards.

```
13)16,666(128,2 grains, or 5 dwts., 8,2 grains,
  13                        weight of 2 yards.
  --
  36
  26
  --
  106
  104
  ---
   26
   26
   --
```

CARDING AND DRAWING TABLE.

From ,13 to ,187 decimal of hank for 2, 4, and 6 yards.

Dec. of	2 yards.		Dec. of	4 yards.			Dec. of	6 yards.		
Hank.	dwts	grains.	hank.	oz	dwts	grains.	hank.	oz	dwts	grns.
,13	5	8,2	,13		10	16,4	,13		16	0,6
,131	5	7,22	,131		10	14,45	,131		15	21,67
,132	5	6,26	,132		10	12,5	,132		15	18,78
,133	5	5,31	,133		10	10,62	,133		15	15,93
,134	5	4,37	,134		10	8,75	,134		15	13,13
,135	5	3,45	,135		10	6,91	,135		15	10,37
,136	5	2,55	,136		10	5,2	,136		15	7,74
,137	5	1,65	,137		10	3,3	,137		15	4,96
,138	5	0,77	,138		10	1,54	,138		15	2,31
,139	4	23,9	,139		9	23,8	,139		14	23,7
,14	4	23,	,14		9	22,	,14		14	21,
,141	4	22,2	,141		9	20,4	,141		14	18,6
,142	4	21,37	,142		9	18,74	,142		14	16,11
,143	4	20,55	,143		9	17,1	,143		14	13,65
,144	4	19,74	,144		9	15,48	,144		14	11,22
,145	4	12,94	,145		9	13,88	,145		14	8,82
,146	4	18,15	,146		9	12,31	,146		14	6,46
,147	4	17,37	,147		9	10,75	,147		14	4,13
,148	4	16,61	,148		9	9,22	,148		14	1,83
,149	4	15,85	,149		9	7,71	,149		13	23,57
,15	4	15,11	,15		9	6,22	,15		13	21,33
,151	4	14,37	,151		9	4,75	,151		13	19,12
,1525	4	13,29	,1525		9	2,57	,1525		13	15,86
,153	4	12,93	,153		9	1,86	,153		13	14,79
,155	4	11,52	,155		8	23,05	,155		13	10,58
,157	4	10,15	,157		8	20,31	,157		13	6,47
,1575	4	9,82	,1575		8	19,6	,1575		13	5,46
,159	4	8,82	,159		8	17,64	,159		13	2,46
,16	4	8,16	,16		8	16,33	,16		13	0,5
,163	4	6,24	,163		8	12,49	,163		12	18,74
,165	4	5,1	,165		8	10,2	,165		12	15,3
,167	4	3,8	,167		8	7,6	,167		12	11,4
,17	4	2,	,17		8	4,	,17		12	6,
,173	4	0,33	,173		8	0,67	,173		12	1,01
,175	3	23,32	,175		7	22,65	,175		11	21,98
,179	3	21,1	,179		7	18,21	,179		11	15,32
,18	3	20,59	,18		7	17,18	,18		11	13,77
,183	3	19,07	,183		7	14,14	,183		11	9,22
,185	3	18,1	,185		7	12,18	,185		11	6,27
,187	3	17,12	,187		7	10,25	,187		11	3,37

What will 4 yards of 0,26 of a hank weigh?

0,26)33,333(128,2 grains, or 5 dwts., 8,2 grains.
26
73
52
213
208
53
52
1

What will 6 yards of 0,335 of a hank weigh?

0,335)50,000(149,25 grains, or 6 dwts. 5¼ grains.
335
1650
1340
3100
3015
850
670
1800
1675
125

If 6 yards of carding, or drawing weigh 6 dwts., 5¼ grains, what will the decimal of the hank be?

6 dwts., 5¼ grains, = 149,25 grns.)50,0000(0,335 decimal of a hank, and opposite which in the table under 6 yards will be found 6 dwts., 5¼ grains.
44775
52250
44775
74750
74625
125

CARDING AND DRAWING TABLE.

From ,19 to ,31 decimal of hank for 2, 4, and 6 yards.

Dec. of	2 yards.		Dec. of	4 yards.			Dec. of	6 yards.		
Hank.	dwts	grains.	hank.	oz	dwts	grains.	hank.	oz	dwts	grns.
,19	3	15,71	,19	7		7,43	,19	10		23,15
,193	3	14,35	,193	7		4,71	,193	10		19,06
,195	3	13,47	,195	7		2,94	,195	10		16,41
,197	3	12,6	,197	7		1,2	,197	10		13,8
,2	3	11,33	,2	6		22,66	,2	10		10,
,203	3	10,09	,203	6		20,2	,203	10		6,3
,205	3	9,3	,205	6		18,6	,205	10		3,9
,207	3	8,51	,207	6		17,03	,207	10		1,54
,21	3	7,36	,21	6		14,73	,21	9		22,1
,213	3	6,24	,213	6		12,49	,213	9		18,74
,215	3	5,51	,215	6		11,03	,215	9		16,55
,217	3	4,8	,217	6		9,6	,217	9		14,41
,22	3	3,75	,22	6		7,51	,22	9		11,27
,223	3	2,73	,223	6		5,46	,223	9		8,21
,225	3	2,07	,225	6		4,14	,225	9		6,22
,227	3	1,42	,227	6		2,84	,227	9		4,26
,23	3	0,46	,23	6		0,92	,23	9		1,38
,233	2	23,53	,233	5		23,06	,233	8		22,59
,235	2	22,92	,235	5		21,84	,235	8		20,76
,237	2	22,32	,237	5		20,64	,237	8		18,97
,24	2	21,44	,24	5		18,88	,24	8		16,33
,243	2	20,58	,243	5		17,17	,243	8		13,76
,245	2	20,02	,245	5		16,04	,245	8		12,06
,247	2	19,47	,247	5		14,95	,247	8		10,42
,25	2	18,66	,25	5		13,33	,25	8		8,
,253	2	17,87	,253	5		11,75	,253	8		5,62
,255	2	17,36	,255	5		10,71	,255	8		4,07
,257	2	16,85	,257	5		9,7	,257	8		2,55
,26	2	16,1	,26	5		8,2	,26	8		0,3
,263	2	15,37	,263	5		6,74	,263	7		22,11
,265	2	14,89	,265	5		5,78	,265	7		20,67
,27	2	13,72	,27	5		3,45	,27	7		17,18
,275	2	12,6	,275	5		1,21	,275	7		13,81
,28	2	11,52	,28	4		23,04	,28	7		10,56
,285	2	10,47	,285	4		20,95	,285	7		7,43
,29	2	9,47	,29	4		18,94	,29	7		4,41
,295	2	8,49	,295	4		16,99	,295	7		1,49
,3	2	7,55	,3	4		15,11	,3	6		22,66
,305	2	6,64	,305	4		13,28	,305	6		19,93
,31	2	5,76	,31	4		11,52	,31	6		17,28

Suppose 2 yards of carding, or drawing weigh 2 dwts., 20 grains, or 68 grains; what proportion of a hank will it be? Thus 2 yards is $\frac{1}{60}$ of a lea, which is equal to 16,666 grains, which must be divided by the weight 2 yards, which is 68 grains.

2 dwts., 20 grains, = 68 grns.)16,666(,245 decimal, or proportion of a hank.
136

306
272

346
340

6

What will 6 yards of 0,4 hank drawing weigh?

0,4)50,00

125 grains, or 5 dwts., 5 grains.

If 6 yards of carding, or drawing weigh 5 dwts., 5 grains; what proportion of a hank will it be?

5 dwts., 5 grains, = 125 grns.)50,000(0,4 proportion of hank.
500

What will 3 yards of 0,7 hank carding, or drawing weigh?

Decimal of a hank, 0,7)25,00

1 dwt., is 24 grns.)35,71(1 dwt., 11,7 grains weight.
24

11.71

What will 4 yards of 0,7 hank carding, or drawing weigh?

Decimal of hank 0,7)33,333

24)47,619(1 dwt., 23,6 grains weight.
24

23,6

CARDING AND DRAWING TABLE.

From ,315 to ,95 decimal of hank for 2, 4, and 6 yards.

Dec. of	2 yards.		Dec. of	4 yards.			Dec. of	6 yards.		
Hank.	dwts.	grains.	hank.	oz	dwts.	grains.	hank.	oz	dwts	grns.
,315	2	4,91	,315		4	9,82	,315		6	14,73
,32	2	4,08	,32		4	8,16	,32		6	12,24
,325	2	3,28	,325		4	6,56	,325		6	9,84
,33	2	2,5	,33		4	5,01	,33		6	7,51
,335	2	1,75	,335		4	3,5	,335		6	5,25
,34	2	1,	,34		4	2,	,34		6	3,
,345	2	0,3	,345		4	0,61	,345		6	0,92
,35	1	23,61	,35		3	23,23	,35		5	22,85
,355	1	22,94	,355		3	21,89	,355		5	20,94
,36	1	22,29	,36		3	20,59	,36		5	18,88
,365	1	21,66	,365		3	19,22	,365		5	16,98
,37	1	21,04	,37		3	18,09	,37		5	15,13
,375	1	20,44	,375		3	16,88	,375		5	13,32
,38	1	19,86	,38		3	15,71	,38		5	11,58
,385	1	19,29	,385		3	14,58	,385		5	9,87
,39	1	18,73	,39		3	13,47	,39		5	8,2
,395	1	18,19	,395		3	12,38	,395		5	6,58
,4	1	17,66	,4		3	11,33	,4		5	5,
,41	1	16,65	,41		3	9,3	,41		5	1,95
,42	1	15,68	,42		3	7,36	,42		4	23,05
,43	1	14,75	,43		3	5,51	,43		4	20,28
,44	1	13,87	,44		3	3,75	,44		4	17,63
,45	1	13,03	,45		3	2,07	,45		4	15,11
,46	1	12,23	,46		3	0,46	,46		4	12,69
,47	1	11,46	,47		2	22,92	,47		4	10,38
,48	1	10,72	,48		2	21,44	,48		4	8,16
,49	1	10,01	,49		2	20,02	,49		4	6,04
,5	1	9,33	,5		2	18,66	,5		4	4,
,52	1	8,05	,52		2	16,1	,52		4	0,15
,54	1	6,86	,54		2	13,72	,54		3	20,59
,56	1	5,76	,56		2	11,52	,56		3	17,28
,58	1	4,73	,58		2	9,47	,58		3	14,2
,6	1	3,77	,6		2	7,55	,6		3	11,33
,65	1	1,64	,65		2	3,28	,65		3	4,92
,7		23,8	,7		1	23,6	,7		2	23,42
,75		22,22	,75		1	20,44	,75		2	18,66
,8		20,83	,8		1	17,66	,8		2	14,5
,85		19,6	,85		1	15,21	,85		2	10,82
,9		18,51	,9		1	13,04	,9		2	7,55
,95		17,54	,95		1	11,08	,95		2	4,62

If 8 yards of drawing weigh 1 oz., 7 dwts., 0.5 grains; what decimal part of a hank will it be?

Then 18 dwts., $5\frac{1}{2}$ grains troy is equal to 1 oz. avoirdupoise; therefore 1 oz., 7 dwts., 0,5 grains will be equal to 25 dwts., 6 grains troy, or 606 grains, which will be the divisor, and 8 yards which is $\frac{1}{4}$ of a lea, or 66,666 grains, will be the dividend.

606 grains.)66,666(0,11 decimal of a hank.
606
606
606

If 10 yards of carding, or drawing weigh 1 oz., 12 dwts., 18,5 grains; what decimal of a hank will it be?

Grains.
1 ounce = 437,5
12 dwts. = 288
18,5

744 grains, in 1 oz., 12 dwts., $18\frac{1}{2}$ grains.

744 grains.)83,333(0,112 decimal of a hank.
744
893
744
1493
1488
5

What will 8 yards of 0,112 of a hank drawing weigh?

Dividend.

0,112)66,666(595,2 grains.
560

1066
1008

586
560

266
224

42

Grains.

1 oz. is 437,5)595,2(1 oz.
437,5
Grains.---
1 dwt. is 24)157,7(6 dwts.
144

13,7 grains.

OR,

1 oz, 6 dwts., 13,7 grains.

CARDING AND DRAWING TABLE.

From ,066 to ,11 decimal of hank for 8, and 10 yards.

Dec. of	8 yards.			Dec. of	10 yards.		
Hank.	oz	dwts	grains.	hank.	oz	dwts	grains.
,066	2	5	15,1	,066	2	16	3,6
,067	2	5	0,	,067	2	15	8,7
,068	2	4	9,4	,068	2	14	14,4
,069	2	3	19,1	,069	2	13	20,7
,07	2	3	5,3	,07	2	13	3,3
,071	2	2	15,9	,071	2	12	10,7
,072	2	2	2,9	,072	2	11	18,4
,073	2	1	14,2	,073	2	11	2,5
,074	2	1	2,	,074	2	10	11,1
,075	2	0	13,8	,075	2	9	20,1
,076	2	0	2,2	,076	2	9	5,4
,077	1	17	20,3	,077	2	8	15,2
,078	1	17	9,2	,078	2	8	1,3
,079	1	16	22,3	,079	2	7	11,8
,08	1	16	11,8	,08	2	6	22,6
,081	1	16	1,5	,081	2	6	9,8
,082	1	15	15,5	,082	2	5	21,2
,083	1	15	5,7	,083	2	5	9,
,084	1	14	20,1	,084	2	4	21,
,085	1	14	10,8	,085	2	4	9,3
,086	1	14	1,6	,086	2	3	21,9
,087	1	13	16,7	,087	2	3	10,8
,088	1	13	8,	,088	2	2	23,9
,089	1	12	23,5	,089	2	2	13,3
,09	1	12	15,2	,09	2	2	2,2
,091	1	12	7,1	,091	2	1	16,7
,092	1	11	23,1	,092	2	1	6,7
,093	1	11	15,3	,093	2	0	21,
,094	1	11	7,7	,094	2	0	11,5
,095	1	11	0,2	,095	2	0	2,1
,096	1	10	16,9	,096	1	17	22,5
,097	1	10	9,7	,097	1	17	13,6
,098	1	10	2,7	,098	1	17	4,8
,099	1	9	19,9	,099	1	16	20,2
,1	1	9	13,1	,1	1	16	11,8
,102	1	9	0,	,102	1	15	19,4
,104	1	8	11,5	,104	1	15	3,7
,106	1	7	23,4	,106	1	14	12,6
,108	1	7	11,7	,108	1	13	22,1
,11	1	7	0,5	,11	1	13	8,

When the proportion or decimal of the hank is found, the following table will shew the dividend for any number of inches in length, from 1 to 36 inches, when the quotient will be the weight in grains,

Inches.	Dividends.	Inches.	Dividends.
1	,23148	19	4,39812
2	,46296	20	4,6296
3	,69444	21	4,86108
4	,92592	22	5,09256
5	1,15740	23	5,32404
6	1,38888	24	5,55555
7	1,62036	25	5,787
8	1,85184	26	6,01848
9	2,08332	27	6,24996
10	2,3148	28	6,48144
11	2,54628	29	6,71292
12	2,77777	30	6,9444
13	3,00924	31	7,17588
14	3,24072	32	7,40736
15	3,4722	33	7,63884
16	3,70368	34	7,87032
17	3,93516	35	8,1018
18	4,16666	36	8,3333

N. B.—The above tables will shew the dividends for any number of inches of lap, or cotton fed on feed cloth at lap machine; the quotient of which will be the weight in grains; the divisor must be invariably the decimal, or proportion of the hank.

If the decimal, or proportion of the hank at the lap machine, according to the draught and doubling be 0,0005; what weight of cotton must be fed on 12 inches of feed cloth at lap machine?

Thus—Dec. of hank, 0,0005)2,7777 dividend for 12 inches.

5555,5 grains, or 12 oz., 12 dwts.,
——— $17\frac{1}{2}$ grains, the weight of cotton required.

N. B.—The loss sustained in working must be added to the net weight according to the number of hanks produced.

CARDING AND DRAWING TABLE.

From ,112 to ,24 decimal of a hank for 8 and 10 yards.

Dec. of	8 yards.			Dec. of	10 yards.		
hank.	oz	dwts	grains.	hank.	oz	dwts	grains.
,112	1	6	13,7	,112	1	12	18,5
,114	1	6	3,2	,114	1	12	5,4
,116	1	5	17,2	,116	1	11	16,8
,118	1	5	7,4	,118	1	11	4,7
,12	1	4	22,	,12	1	10	16,6
,122	1	4	12,9	,122	1	10	5,5
,124	1	4	4,2	,124	1	9	18,5
,126	1	3	19,6	,126	1	9	7,8
,128	1	3	11,3	,128	1	8	21,5
,13	1	3	3,3	,13	1	8	11,5
,132	1	2	19,5	,132	1	8	1,8
,134	1	2	12,	,134	1	7	15,6
,136	1	2	4,6	,136	1	7	7,2
,138	1	1	21,5	,138	1	6	22,3
,14	1	1	14,6	,14	1	6	13,7
,142	1	1	7,9	,142	1	6	5,3
,144	1	1	0,7	,144	1	5	21,2
,146	1	0	19,1	,146	1	5	12,6
,148	1	0	12,9	,148	1	5	6,
,15	1	0	6,9	,15	1	4	22,
,1525		18	5,1	,1525	1	4	12,9
,155		17	22,1	,155	1	4	4,1
,1575		17	15,2	,1575	1	3	19,6
,16		17	8,6	,16	1	3	11,3
,165		16	20,	,165	1	2	19,5
,17		16	8,1	,17	1	2	4,5
,175		15	20,9	,175	1	1	14,6
,18		15	10,	,18	1	1	1,4
,185		15	0,3	,185	1	0	12,9
,19		14	14,8	,19	1	0	1,1
,195		14	5,8	,195		17	19,3
,2		13	21,3	,2		17	8,6
,205		13	13,2	,205		16	22,5
,21		13	5,4	,21		16	12,8
,215		12	22,	,215		16	3,5
,22		12	15,	,22		15	18,7
,225		12	8,2	,225		15	10,3
,23		12	1,8	,23		15	2,3
,235		11	19,6	,235		14	18,6
,24		11	13,7	,24		14	11,2

If 8 yards of carding, or drawing weigh 16 dwts., 20 grains; what proportion, or size of hank will it be?

Then 16 dwts., 20 grains are equal to 404 grains, which will be the divisor; and 8 yards are $\frac{1}{10}$ of a lea, or 66,666 grains which will be the dividend.

```
404)66,666(0,165 decimal, or proportion of hank,
   404           opposite to which in the table
  ----           under 8 yards, is 16 dwts., 20
  2626                        grains, the weight.
  2424
  ----
   2026
   2020
  ----
      6
  ----
```

If 8 yards of carding, or drawing weigh 4 dwts., 5 grains; what proportion, or size of hank will it be?

```
4 dwts., 5 grains, are equal to 101 grns.)66,666(0,66 proportion, or
                                606          size of hank.
                                ---
                                606
                                606
                                ---
```

What will 8 yards of 0,165 of a hank of carding, or drawing weigh?

Then 8 yards are $\frac{1}{10}$ of a lea, which is equal to 66,666 grains, which will be the dividend, and the decimal of the hank 0,165 the divisor.

```
0,165)66,666(404  grains, or 16 dwts., 20 grains,
   660            which will be found in the column
  ----            under 8 yards; to the left hand
    666           of which will be found 0,165,
    660           which is the decimal, or size of
  ----            a hank for 8 yards of carding,
      6           or drawing that weighs 16
  ----            dwts., 20 grains.
```

CARDING AND DRAWING TABLE.

From ,245 to ,48 decimal of hank for 8, and 10 yards.

Dec. of	8 yards.			Dec. of	10 yards.		
Hank.	oz.	dwts	grains.	hank.	oz	dwts	grains.
,245		11	8,1	,245		14	4,
,25		11	2,6	,25		13	21,3
,255		10	21,4	,255		13	14,7
,26		10	16,4	,26		13	8,5
,265		10	11,5	,265		13	2,4
,27		10	6,9	,27		12	20,6
,275		10	2,4	,275		12	15,
,28		9	22,	,28		12	9,6
,285		9	17,9	,285		12	4,3
,29		9	13,8	,29		11	23,3
,295		9	9,9	,295		11	18,4
,3		9	6,2	,3		11	13,7
,305		9	2,5	,305		11	9,2
31		8	23,	,31		11	4,8
,315		8	19,6	,315		11	0,5
,32		8	16,3	,32		10	20,4
,325		8	13,1	,325		10	16,4
,33		8	10,	,33		10	12,5
,335		8	7,	,335		10	8,7
,34		8	4,	,34		10	5,
,345		8	1,2	,345		10	1,5
,35		7	22,4	,35		9	22,
,355		7	19,7	;355		9	18,7
,36		7	17,1	,36		9	15,4
,365		7	14,6	,365		9	12,3
,37		7	12,1	,37		9	9,2
,375		7	9,7	,375		9	6,2
,38		7	7,4	,38		9	3,3
,385		7	5,1	,385		9	0,4
,39		7	2,9	,39		8	21,6
,395		7	0,7	,395		8	18,9
,4		6	22,6	,4		8	16,3
,41		6	18,6	,41		8	11,2
,42		6	14,7	,42		8	6,4
,43		6	11,	,43		8	1,8
,44		6	7,5	,44		7	21,3
,45		6	4,1	,45		7	17,1
,46		6	0,9	,46		7	13,1
,47		5	21,8	,47		7	9,3
,48		5	18,8	,48		7	5,6

What will 18 yards of $1\frac{1}{4}$ hank slabbing weigh?

Then 18 yards is $\frac{3}{20}$ of a lea, or 120 yards, which is equal to 150 grains of a 1 hank, which divided by $1\frac{1}{4}$, or 1,25 will give the weight in grains that 18 yards should weigh.

Grains.

Hank slabbing 1,25)150,0(120 grains, or 5 dwts., weight required.

125

250
250

If 18 yards of slabbing weigh 5 dwts., or 120 grains; what hank will it be?

120)150,00(1,25 hank slabbing.
120

300
240

600
600

What will 37 yards of $1\frac{3}{4}$ hank slabbing weigh?

Then 37 yards is $\frac{37}{120}$ of a lea, or 120 yards, which is equal to 308,333 grains of a 1 hank, which divided by $1\frac{3}{4}$, or 1,75 will give the weight in grains that 37 yards should weigh.

1,75)308,3333(176,19 grains, or 7 dwts., 8,19 grains, weight required.
175

1333
1225

1083
1050

333
175

1583
1575

8

CARDING, DRAWING, AND SLABBING TABLE.

From ,5 to ,99 decimal of hank for 8, 10, and 20 yards.

Dec. of	8 yards.		Dec. of	10 yards.			Dec. of	20 yards.		
Hank.	dwts	grains.	hank.	oz	dwts	grains.	hank.	oz	dwts	grns.
,5	5	13,3	,5		6	22,6	,5		13	21,2
,51	5	10,7	,51		6	19,4	,51		13	14,8
,52	5	8,2	,52		6	16,2	,52		13	8,4
,53	5	5,7	,53		6	13,2	,53		13	2,4
,54	5	3,4	,54		6	10,3	,54		12	20,6
,55	5	1,2	,55		6	7,5	,55		12	15,
,56	4	23,	,56		6	4,8	,56		12	9,6
,57	4	20,9	,57		6	2,2	,57		12	4,4
,58	4	18,9	,58		5	23,6	,58		11	23,2
,59	4	17,	,59		5	21,2	,59		11	18,4
,6	4	15,1	,6		5	18,8	,6		11	13,6
,62	4	11,5	,62		5	14,4	,62		11	4,8
,64	4	8,1	,64		5	10,2	,64		10	20,4
,66	4	5,	,66		5	6,	,66		10	12,
,68	4	2,	,68		5	2,5	,68		10	5,
,7	3	23,2	,7		4	23,	,7		9	22,
,72	3	20,6	,72		4	19,6	,72		9	15,2
,74	3	18,	,74		4	16,6	,74		9	9,2
,76	3	15,7	,76		4	13,6	,76		9	3,2
,78	3	13,4	,78		4	10,8	,78		8	21,6
,8	3	11,3	,8		4	8,1	,8		8	16,2
,81	3	10,3	,81		4	6,8	,81		8	13,7
,82	3	9,3	,82		4	5,6	,82		8	11,2
,83	3	8,2	,83		4	4,3	,83		8	8,8
,84	3	7,3	,84		4	3,2	,84		8	6,4
,85	3	6,4	,85		4	2,	,85		8	4,
,86	3	5,5	,86		4	0,9	,86		8	1,8
,87	3	4,6	,87		3	23,7	,87		7	23,5
,88	3	3,7	,88		3	22,7	,88		7	21,4
,89	3	2,9	,89		3	21,6	,89		7	19,2
,9	3	2,	,9		3	20,6	,9		7	17,2
,91	3	1,2	,91		3	19,5	,91		7	15,1
,92	3	0,4	,92		3	18,6	,92		7	13,2
,93	3	23,6	,93		3	17,5	,93		7	11,2
,94	2	23,	,94		3	16,6	,94		7	9,2
,95	2	22,1	,95		3	15,6	,95		7	7,3
,96	2	21,4	,96		3	14,8	,96		7	5,6
,97	2	20,7	,97		3	13,9	,97		7	3,8
,98	2	20,	,98		3	13,	,98		7	2,
,99	2	19,3	,99		3	12,1	,99		7	0,3

The slabbing and roving tables rise progressively in 20th parts of a hank, as will be seen in the following tables. Thus 1, 1,05, or $1\frac{1}{20}$ and so on to 2 and 3 hank, &c.

What will 20 yards of $1\frac{1}{4}$, or 1,25 hank slabbing weigh?

Then 20 yards is $\frac{1}{6}$ of a lea, or 120 yards, which is equal to 166,66 grains of a 1 hank, as shewn in a preceding table; which, divided by $1\frac{1}{4}$, or 1,25, will give the weight in grains that 20 yards should weigh.

Grains.

Hank slabbing, 1,25)166,66(133,33, or 5 dwts., $13\frac{3}{10}$ grains weight, which will be found in the table opposite 1,25, and under 20 yards.

125

416
375

416
375

416
375

416
375

41

If 20 yards of slabbing weigh 5 dwts., 13,3 grains; what hank will it be?

5 dwts., 13,3 grains = 133,33)166,66(1,25, or $1\frac{1}{4}$ hank slabbing.

13333

33336
26666

66706
66666

40

SLABBING AND ROVING TABLE.

From 1, hank to 2,95 hanks for 20, 30, 40, and 60 yards.

Hank	20 yards.		30 yards.			40 yards.		60 yards.		
roving.	dwts.	grains.	oz	dwts.	grains.	dwts.	grains.	oz	dwts	grns.
1,	6	22,6		10	10,	13	21,3	1	2	14,5
1,05	6	14,7		9	22,	13	5,4	1	1	14,7
1,1	6	7,5		9	11,2	12	15,	1	0	17,
1,15	6	0,9		9	1,3	12	1,8		18	2,7
1,2	5	18,8		8	16,3	11	13,7		17	8,6
1,25	5	13,3		8	8,	11	2,6		16	16,
1,3	5	8,2		8	0,3	10	16,4		16	0,6
1,35	5	3,4		7	17,1	10	6,9		15	10,3
1,4	4	23,		7	10,5	9	22,		14	21,1
1,45	4	18,9		7	4,4	9	13,8		14	8,8
1,5	4	15,1		6	22,6	9	6,2		13	21,3
1,55	4	11,5		6	17,2	8	23,		13	10,5
1,6	4	8,1		6	12,2	8	16,3		13	0,5
1,65	4	5,1		6	7,6	8	10,2		12	15,
1,7	4	2,		6	3,	8	4,		12	6,1
1,75	3	23,9		5	22,8	7	22,4		11	21,7
1,8	3	20,6		5	18,8	7	17,1		11	13,7
1,85	3	18,		5	15,1	7	12,1		11	6,2
1,9	3	15,7		5	11,5	7	7,4		10	23,1
1,95	3	13,4		5	8,2	7	2,9		10	16,4
2,	3	11,3		5	5,	6	22,6		10	10,
2,05	3	9,3		5	1,9	6	18,6		10	3,8
2,1	3	7,3		4	23,	6	14,7		9	22,
2,15	3	5,5		4	20,2	6	11,		9	16,4
2,2	3	3,7		4	17,6	6	7,5		9	11,3
2,25	3	2,		4	15,1	6	4,1		9	6,2
2,3	3	0,4		4	12,6	6	0,9		9	1,3
2,35	2	22,9		4	10,3	5	21,8		8	10,6
2,4	2	21,4		4	8,1	5	18,8		8	16,2
2,45	2	20,		4	6,	5	16,		8	12,
2,5	2	18,6		4	4,	5	13,3		8	8,
2,55	2	17,3		4	2,	5	10,7		8	4,
2,6	2	16,1		4	0,1	5	8,2		8	0,3
2,65	2	14,9		3	22,3	5	5,7		7	20,6
2,7	2	13,7		3	20,6	5	3,4		7	17,2
2,75	2	12,6		3	18,9	5	1,2		7	13,8
2,8	2	11,5		3	17,2	4	23,		7	10,5
2,85	2	10,4		3	15,7	4	20,9		7	7,4
2,9	2	9,4		3	14,2	4	18,9		7	4,4
2,95	2	8,5		3	12,7	4	17,		7	1,5

What will 30 yards of $2\frac{9}{10}$ hank roving weigh?

250 is the dividend for 30 yards, which must be divided by the hank roving, and the quotient will be the weight in grains.

Hank roving, 2,9)250(86,2 grains, or 3 dwts., 14,2 grains, which will be found in the table under 30 yards, and opposite 2,9 in the column of the hank roving.

232
180
174
60
58
2

If 40 yards weigh 4 dwts., 5 grains; what hank roving will it be?

4 dwts., 5 grains, = 101 grns.)333,33(3,3, or $3\frac{3}{10}$ hank roving.

303
303
303

What will 60 yards of $3\frac{3}{4}$, or 3,75 hank roving weigh?

500 is the dividend for 60 yards.

Hank roving $3\frac{3}{4}$, or 3,75)500,00(133,3, or 5 dwts., 13,3 grains weight of 60 yards of a $3\frac{3}{4}$ hank roving.

375
250
1125
1250
1125
1250
1125
125

ROVING TABLE.

From 3, hank to 7,25 hanks, for 20, 30, 40, and 60 yards.

Hank	20 yards.		30 yards.		40 yards.		60 yards.	
roving.	dwts.	grains.	dwts.	grains.	dwts	grains.	dwts	grains.
3,	2	7,5	3	11,3	4	15,1	6	22,6
3,05	2	6,6	3	9,9	4	13,2	6	19,9
3,1	2	5,7	3	8,6	4	11,5	6	16,3
3,15	2	4,9	3	7,3	4	9,8	6	14,7
3,2	2	4,	3	6,1	4	8,1	6	12,2
3,25	2	3,2	3	4,9	4	6,5	6	9,8
3,3	2	2,5	3	3,7	4	5,	6	7,5
3,35	2	1,7	3	2,6	4	3,5	6	5,2
3,4	2	1,	3	1,5	4	2,	6	3,
3,45	2	0,3	3	0,4	4	0,6	6	0,9
3,5	1	23,6	2	23,4	3	22,2	5	22,8
3,55	1	22,9	2	22,4	3	21,9	5	20,8
3,6	1	22,3	2	21,4	3	20,6	5	18,8
3,65	1	21,6	2	20,5	3	19,3	5	16,9
3,7	1	21,	2	19,5	3	18,1	5	15,1
3,75	1	20,4	2	18,6	3	16,8	5	13,3
3,8	1	19,8	2	17,7	3	15,7	5	11,5
3,85	1	19,2	2	16,9	3	14,5	5	9,9
3,9	1	18,7	2	16,1	3	13,4	5	8,2
3,95	1	18,1	2	15,3	3	12,4	5	6,6
4,	1	17,6	2	14,5	3	11,3	5	5,
4,1	1	16,6	2	12,9	3	9,3	5	1,9
4,2	1	15,7	2	11,5	3	7,3	4	23,
4,3	1	14,7	2	10,1	3	5,5	4	20,2
4,4	1	13,8	2	8,8	3	3,7	4	17,6
4,5	1	13,	2	7,5	3	2,	4	15,1
4,6	1	12,2	2	6,3	3	0,4	4	12,7
4,7	1	11,4	2	5,2	2	22,9	4	10,4
4,8	1	10,7	2	4,1	2	21,4	4	8,1
4,9	1	10,	2	3,	2	20,	4	6,
5,	1	9,3	2	2,	2	18,6	4	4,
5,25	1	7,6	1	23,6	2	15,2	3	23,2
5,5	1	6,3	1	21,4	2	12,6	3	18,9
5,75	1	4,9	1	19,5	2	9,9	3	15,
6,	1	3,7	1	17,6	2	7,5	3	11,3
6,25	1	2,6	1	16,	2	5,3	3	8,
6,5	1	1,6	1	14,4	2	3,2	3	4,9
6,75	1	0,6	1	13,	2	1,3	3	2,
7,		23,8	1	11,7	1	23,6	2	23,4
7,25		22,9	1	10,4	1	21,9	2	20,9

CHANGE PINIONS AT ROVING FRAME.

By changing the driving wheels, less pinions produce finer roving, by increasing the draught in rollers: driven wheels decrease the hank roving by reducing the draught in the rollers.

RULE.—Multiply the hank roving by the number of teeth in the change wheel, or pinion, and divide by the hank roving you want, and the quotient will be the change wheel, or pinion required.

If a 4 hank roving requires a 24 teeth change wheel, or pinion; what will a 4¾ hank require?

4 hank roving.
24 teeth, change wheel, or pinion.

Hank rov. required, 4,75)96,00(20,21, or 20 teeth, change pinion, being a driving wheel.
9500

1000
950

500
475

25

If a 4 hank roving requires a 48 teeth (driven) change wheel, or pinion; what will a 4¼ hank require?

4 hank roving.
48 teeth, change wheel.

Hank roving required, 4,25)192,00(45,17, or 45 teeth, change wheel, or pinion required, being a driven wheel.
1700

2200
2125

750
425

3250
2975

275

N. B.—It seldom occurs that a change wheel can be had to produce exactly what is wanted.

ROVING TABLE.

From 7,5 to 18,5 hanks for 30, 40, 60, and 120 yards.

Dec. of	30 yards.		40 yards.		60 yards.			120 yds. or 1 lea		
Hank.	dwts	grains.	dwt.	grains.	oz	dwts	grains.	oz	dwts	grns.
7,5	1	9,3	1	20,4		2	18,6		5	13,3
7,75	1	8,2	1	19,		2	16,5		5	9,
8,	1	7,2	1	17,6		2	14,5		5	5,
8,25	1	6,3	1	16,4		2	12,6		5	1,2
8,5	1	5,4	1	15,2		2	10,8		4	21,6
8,75	1	4,5	1	14,1		2	9,1		4	18,2
9,	1	3,7	1	13,		2	7,5		4	15,1
9,25	1	3,	1	12,		2	6,		4	12,
9,5	1	2,3	1	11,1		2	4,6		4	9,2
9,75	1	1,6	1	10,1		2	3,2		4	6,4
10,	1	1,	1	9,33		2	2,		4	4,
10,25	1	0,39	1	8,52		2	0,78		4	1,56
10,5		23,81	1	7,73		1	23,62		3	23,23
10,75		23,26	1	7,		1	22,52		3	21,04
11,		22,72	1	6,3		1	22,15		3	18,9
11,25		22,22	1	5,62		1	20,44		3	16,88
11,5		21,73	1	4,98		1	19,47		3	14,95
11,75		21,27	1	4,33		1	18,55		3	13,1
12,		20,83	1	3,77		1	17,66		3	11,33
12,25		20,4	1	3,2		1	16,81		3	9,6
12,5		20,	1	2,66		1	16,		3	8,
12,75		19,6	1	2,14		1	15,21		3	6,43
13,		19,23	1	1,64		1	14,46		3	4,92
13,25		18,86	1	1,16		1	13,73		3	3,47
13,5		18,51	1	0,69		1	13,03		3	2,07
13,75		18,18	1	0,24		1	12,36		3	0,72
14,		17,85		23,8		1	11,71		2	23,42
14,25		17,54		23,39		1	11,08		2	22,17
14,5		17,24		22,98		1	10,48		2	20,96
14,75		16,94		22,89		1	9,89		2	19,79
15,		16,66		22,22		1	9,33		2	18,66
15,25		16,39		21,85		1	8,78		2	17,57
15,5		16,12		21,52		1	8,25		2	16,57
15,75		15,87		21,16		1	7,74		2	15,49
16,		15,62		20,83		1	7,25		2	14,5
16,5		15,15		20,2		1	6,3		2	12,6
17,		14,7		19,6		1	5,41		2	10,82
17,5		14,28		19,05		1	4,57		2	9,14
18,		13,88		18,51		1	3,77		2	7,55
18,5		13,51		18,01		1	3,02		2	6,05

If 30 yards of roving with a 24 teeth change wheel, weigh 2 dwts., 14½ grains; what number of grains will the same length weigh with a 22 teeth change wheel (driving)?

2 dwts., 14½ grains, = 62,5 grns., weight of 30 yds. with 24 tth. whl.
22 teeth change wheel.

1250
1250

Chn. whl. 24 teeth.)1375,0(57,29, or 2 dwts., 9¼ grains.
120

175
168

70
48

220
216

4

If 62½ grains of roving require a 24 teeth change wheel, or pinion; what change wheel, or pinion will there be required to produce a hank roving the same length which will weigh 57¼ grains?

57,25 grains, weight required.
24 teeth, change pinion, or wheel.

22900
11450

Given weight, 62,5 grains.)1374,00(22 teeth, nearly, change wheel,
1250 or pinion required.

1240
1250—nearly.

N. B.—When the number of grains which any given length weighs, is taken instead of the hank, multiply the grains by the change wheel, or pinion you intend putting on, and divide by the change wheel you have working, and the quotient will be the weight in grains required.

The following will be the dividends for any number of leas, from 1 to 7 leas, or 1 hank.

N. B.—For as many leas that you weigh, take as many thousands for your dividend, as shewn in the annexed table of dividends.

Leas.	Dividends.
1	1000
2	2000
3	3000
4	4000
5	5000
6	6000
7	7000

What will 2 leas of 22½ hank roving, or yarn weigh?

Hank roving, or yarn, 22,5)2000,0(88,888 grs., or 3 dwts, 16,88 grs.

1800

2000
1800

2000
1800

2000
1800

2000
1800

200

If 2 leas weigh 3 dwts., 17 grains; what hank will it be?

3 dwts., 17 grains=89 grns.)2000(22,5, or 22½ hanks, nearly.

178

220
178

420
445—nearly.

ROVING AND YARN TABLE.

From 19, to 33,5 hanks for 1, 2, 3, and 4 leas.

Hank	1 lea.		2 leas.			3 leas.		4 leas.		
roving.	dwts.	grains.	oz	dwts.	grains.	dwts.	grains.	oz	dwts	grns.
19,	2	4,63		4	9,26	6	13,89		8	18,52
19,5	2	2,28		4	6,56	6	9,84		8	13,12
20,	2	2,		4	4,	6	6,		8	8,
20,5	2	0,78		4	1,56	6	2,34		8	3,12
21,	1	23,61		3	23,23	5	22,85		7	22,47
21,5	1	22,51		3	21,02	5	19,53		7	18,40
22,	1	21,45		3	18,9	5	16,36		7	13,81
22,5	1	20,44		3	16,88	5	13,33		7	9,77
23,	1	19,47		3	14,95	5	10,43		7	5,61
23,5	1	18,55		3	13,1	5	7,65		7	2,2
24,	1	17,66		3	11,33	5	5,		6	22,6
24,5	1	16,81		3	9,63	5	2,44		6	19,26
25,	1	16,		3	8,	5	0,		6	16,
25,5	1	15,21		3	6,43	4	21,64		6	12,86
26,	1	14,46		3	4,92	4	19,38		6	9,84
26,5	1	13,73		3	3,47	4	17,2		6	6,94
27,	1	13,03		3	2,07	4	15,11		6	4,14
27,5	1	12,36		3	0,72	4	13,09		6	1,44
28,	1	11,71		2	23,42	4	11,14		5	22,85
28,5	1	11,08		2	22,17	4	9,26		5	20,34
29,	1	10,48		2	20,96	4	7,44		5	17,93
29,5	1	9,89		2	19,79	4	5,69		5	15,58
30,	1	9,33		2	18,66	4	4,		5	13,33
30,5	1	8,78		2	17,57	4	2,36		5	11,14
31,	1	8,25		2	16,51	4	0,76		5	9,03
31,5	1	7,74		2	15,39	3	23,23		5	6,78
32,	1	7,22		2	14,5	3	21,75		5	5,
32,5	1	6,76		2	13,53	3	20,3		5	3,16
33,	1	6,3		2	12,6	3	18,9		5	1,21
33,5	1	5,85		2	11,7	3	17,55		4	23,4

For Yarn Tables from No. 1 *to* 300, *and from* 1 *to* 7 *leas, and* 10 *hanks in length, see Tables published by* ROBERT SCOTT.

SELF-ACTING MULES.

THE following calculations are taken from MESSRS. SHARP and ROBERTS'S self acting mule; the merits of which, with the recent improvements, are already known amongst the most extensive cotton spinners, not only in this country but in most others where the cotton spinning business has been introduced.

The speed of the twist shaft is required from the following particulars?

Revolutions of lying shaft per minute, 136.
Diameter of drum on shaft, 21 inches.
Diameter of pulley on counter shaft, 14 inches.
Diameter of drum on counter shaft, 16 inches.
Diameter of pulleys on twist shaft, 12 inches.

136 revolutions of lying shaft per minute.
21 inches, diameter of drum on do.

136
272

2856
16 inches, diameter of drum on counter shaft.

17136
2856

45696 dividend.

14 inches, diameter of pulley on counter shaft.
12 inches, diameter of pulleys on twist shaft.

168 divisor.

168)45696(272 revolutions of twist shaft per min
336

1209
1176

336
336

N. B.—The self-acting mules from which these calculations are made are spinning numbers 36*'s pin cops for power loom weaving.*

The speed of the spindles, is required from the following particulars?

Revolutions of twist shaft per minute, 272.
Diameter of grooved pulley on twist shaft, $17\frac{3}{8}$ inches.
Diameter of grooved twist pulley for driving vertical shaft, $10\frac{1}{4}$ in.
Diameter of grooved pulley on vertical shaft, $10\frac{1}{4}$ inches.
Diameter of grooved pulley on tin drums, 10 inches.
Diameter of tin drums, driving spindles, 10 inches.
Diameter of spindle wharves, $\frac{7}{8}$ inch.

N. B.—There are generally 3 *grooves in the band pulley on the twist shaft, the diameters of which are* $17\frac{3}{8}$, 18, *and* $18\frac{3}{8}$ *inches.*

When the driving and driven pulleys, or drums, are alternately of the same dimensions as in the above question, they are omitted in the work.

272 revolutions of twist shaft per minute.
17,375, or $17\frac{3}{8}$ inches, diameter of groove in pulley on twist shaft.

1360
1904
816
1904
272

4726,000 dividend.

The divisor will be ,875, which is equal to 7-8ths of an inch, the diameter of the spindle wharves.

,875)4726,000(5401,1428 revolutions of spindles per minute.
4375

3510
3500

1000
875

1250
875

3750
3500

2500

2500
1750

7500
7000

500

The speed of the vertical shaft, is required from the following particulars?

Revolutions of twist shaft per minute, 272.

Diameter of groove in pulley on twist shaft, $17\frac{3}{8}$ inches.

Diameter of grooved twist pulley for driving vertical shaft, $10\frac{1}{4}$ in.

272 revolutions of twist shaft per minute.
17,375, or $17\frac{3}{8}$ inches, diameter of groove in pulley on twist shaft.

1360
1904
816
1904
272

4726,000 dividend.

The divisor will be 10,25, or $10\frac{1}{4}$ inches, the diameter of the grooved twist pulley for driving vertical shaft.

10,25)4726,00(461,07317 revolutions of vertical shaft per minute.
4100

6260
6150

1100
1025

7500
7175

3250
3075

1750
1025

7250
7175

75

N. B.—There is a 40 *teeth wheel on the grooved twist pulley shaft, which works into a* 40 *teeth wheel on the foot of the vertical shaft; but one being a driving and the other a driven wheel, and each containing the same number of teeth, they are omitted in the above question and example.*

The speed of the front rollers, is required from the following particulars :

Revolutions of twist shaft per minute. 272.
Back pinion on twist shaft, 18 teeth.
Back intermediate wheel, 42 teeth.
Back adjustable intermediate wheel, 70 teeth.
Back change wheel on back shaft, 50 teeth.
Wheel on back shaft driving front rollers, 40 teeth.
Wheel on front rollers, connected with catch box, 40 teeth.

272 revolutions of twist shaft per minute.
18 teeth, back pinion on do.

2176
272

4896 dividend

The divisor will be 50, being the number of teeth in the change wheel on the back shaft. All the other wheels, with the exception of the back pinion on the twist shaft are omitted, on account of being connecting, or driving and driven wheels containing the same number of teeth.

5,0)489,6

97,92 revolutions of front rollers per minute.

If the front rollers at the mules be 1 inch diameter, making 97,92 revolutions per minute; how many inches will they traverse ?

3,1416 circumference when the diameter is 1.
97,92 revolutions of front rollers per minute.

62832
282744
219912
282744

307,625472 inches, front rollers traverse per minute.

The speed of the middle rollers, is required from the following particulars?

Revolutions of front rollers per minute, 97,92.
Wheel on the front rollers, 20 teeth.
Crown wheel, 108 teeth.
Change pinion, 24 teeth.
Wheel on the back rollers, 50 teeth.
Wheel on the end of back rollers, working into stud wheel which drives middle rollers, 32 teeth.
Wheel on the middle rollers, 25 teeth.

97,92 revolutions of front rollers per minute.
20 teeth, wheel on do.

1958,40
24 teeth, change pinion.

78336
39168

47001,6
32 teeth, wheel on the end of back rollers.

940032
1410048

1504051,2 dividend.

108 teeth, crown wheel.
50 teeth, wheel on the back rollers.

5400
25 teeth, wheel on the middle rollers.

27000
10800

135000 divisor.

135,000 thus
5 x 9 x 3 = 135

5)1504,051,2
9)300,81024
3)33,42336
11,14112 revolutions of middle rollers per minute.

If the middle rollers be ¾ of an inch diameter, making 11,14112 revolutions per minute; how many inches will they traverse?

11,14112 revolutions of middle rollers per min.
,75, or ¾ inch diameter of do.

5570560
7798784

8,3558400
3,1416 circumference when the diameter is 1.

5013504
835584
3342336
835584
2506752

26,250706944, or rather more than 26¼ inches, middle rollers traverse per minute.

The speed of the back rollers, is required from the following particulars?

Revolutions of the front rollers per minute, 97,92.
Wheel on the front rollers, 20 teeth.
Crown wheel, 108 teeth.
Change pinion, 24 teeth.
Wheel on the back rollers, 50 teeth.

97,92 revolutions of front rollers per minute.
20 teeth, wheel on do.

1958,40
24 teeth, change pinion.

78336
39168

47001,6 dividend.

108 teeth, crown wheel.
50 teeth, wheel on the back rollers.

54,00 divisor, or 9 x 6=54

9)470,01,6
6)52,224

8,704 revolutions of back rollers per minute.

If the back rollers be 7-8ths of an inch diameter, making 8,704 revolutions per minute; how many inches will they traverse?

8,704 revolutions of back rollers per minute.
,875, or 7-8ths of an inch, diam. of rollers.

43520
60928
69632

7,616000
3,1416 circumference when the diameter is 1.

45696
7616
30464
7616
22848

23,9264256, or nearly 24 inches, back rollers traverse per minute.

The draught between the middle and back rollers, is required from the following particulars?

Middle rollers traverse 26,250706944 inches per minute.
Back rollers traverse 23,9264256 inches per minute.

23,9264256)26,250706944(1,0971428, or nearly $1\frac{1}{10}$ draught
239264256 between the mid. and back rols.

2324281344
2153378304

1709030400
1674849792

341806080
239264256

1025418240
957057024

68361216C
478528512

2050836480
1914114048

136722432

The draught between the front and middle rollers, is required from the following particulars?

Front rollers traverse 307,625472 inches per minute.

Middle rollers traverse 26,250706944 inches per minute.

26,250706944)307,62547200(11,71875 draught, between the front and middle rollers.

26250706944

45118402560
26250706944

188676956160
183754948608

49220075520
26250706944

229693685760
210005655552

196880302080
183754948608

131253534720
131253534720

The draught between the front and back rollers, is required from the following particulars?

Front rollers traverse 307,625472 inches per minute.

Back rollers traverse 23,9264256 inches per minute

23,9264256)307,625472(12,85" draught, between the front and back rollers

239264256

683612160
478528512

2050836480
1914114048

1367224320
1196321280

1709030400
1674849792

34180608

The draught between the front and back rollers, is required from the following particulars?

Draught between the front and middle rollers, 11,71875.

Draught between the middle and back rollers, 1,09714.

11,71875 draught, between front and mid. rols.
1,09714 draught, between middle & back rols

4687500
1171875
8203125
10546875
11718750

12,8571093750 draught, between the front & back rols.

The draught between the front and middle rollers, is required from the following particulars?

Wheel on front rollers, 20 teeth.
Crown wheel, 108 teeth.
Change pinion, 24 teeth.
Wheel on back rollers, 50 teeth.
Wheel on the end of back rollers, working a stud wheel which drives the middle rollers, 32 teeth.
Wheel on middle rollers, 25 teeth.
Diameter of front rollers, 1 inch, or 8-8ths.
Diameter of middle rollers, $\frac{3}{4}$ inch, or 6-8ths

Driving wheels.
20 teeth, wheel on front rollers.
24 teeth, change pinion.

480
32 teeth, wheel on the end of back rollers.

960
1440

15360
6-8ths, or $\frac{3}{4}$ inch diameter of middle rollers.

92160 divisor

(Continued.)

Driven wheels.

108 teeth, crown wheel.
50 teeth, wheel on back rollers.

5400
25 teeth, wheel on middle rollers.

27000
10800

135000
8-8ths, or 1 inch, diameter of front rols.

1080000 dividend.

92160)1080000(11,71875 draught, between the front and middle rollers.
92160

158400
92160

662400
645120

172800
92160

806400
737280

691200
645120

460800
460800

The draught between the front and back rollers, is required from the following particulars?

Wheel on front rollers, 20 teeth.
Crown wheel, 108 teeth.
Change pinion, 24 teeth.
Wheel on back rollers, 50 teeth.
Diameter of front rollers, 1 inch, or 8-8ths.
Diameter of back rollers, $\frac{7}{8}$ inch, or 7-8ths.

Driving wheels.
20 teeth, wheel on front rollers.
24 teeth, change pinion.

480
7-8ths, or $\frac{7}{8}$ inch, diam. of back rollers.

3360 divisor.

Driven wheels.
108 teeth, crown wheel.
50 teeth, wheel on back rollers.

5400
8-8ths, or 1 inch, diameter of front rollers.

43200 dividend.

3360)43200(12,8571 draught, between the front and back rollers.
3360

9600
6720

28800
26880

19200
16800

24000

24000
23520

4800
3360

1440

N. B.—By examining the different systems of working draughts as shewn in the last examples, it will be found that they all agree with each other, therefore any of the systems may be adopted.

The speed of the long drawing out shaft, is required from the following particulars?

Revolutions of twist shaft per minute, 272.
Back pinion on twist shaft, 18 teeth.
* { Back intermediate wheel, 42 teeth.
{ Back adjustable intermediate wheel, 70 teeth.
Back change wheel on back shaft driving front rollers, 50 tth.
Wheel on back shaft, 19 teeth.
Back change wheel on long drawing out shaft, 61 teeth.

272 revolutions of twist shaft per minute.
18 teeth, back pinion on twist shaft.

2176
272

4896
19 teeth, wheel on back shaft.

44064
4896

93024 dividend.

50 teeth, change wheel on back shaft, for driving front rols.
61 teeth, back change wheel on long drawing out shaft.

3050 divisor.

3050)93024(30,499, or nearly 30½ revolutions of
9150 long drawing out shaft per min.

15240
12200

30400
27450

29500
27450

2050

* These are only carrying, or connecting wheels, consequently they are omitted in the work.

The speed of the drawing out scroll shaft, is required from the following particulars?

Revolutions of long drawing out shaft per minute, 30,5.
Bevil wheel on long drawing out shaft, 24 teeth.
Bevil wheel on scroll shaft, 48 teeth.

30,5 revols. of long drawing out shaft per min.
24 teeth, bevil wheel on do.

1220
610

Bev. whl. on scroll shaft, 48 tth.)732,0(15,25 revolutions of drawing out scroll shaft per minute.

48
252
240
120
96
240
240

The speed of the drawing out scroll shaft, is required from the following particulars?

Revolutions of twist shaft per minute, 272.
Back pinion on twist shaft, 18 teeth.
Back change wheel on back shaft, for driving front rollers, 50 teeth.
Wheel on back shaft, 19 teeth.
Back change wheel on long drawing out shaft, 61 teeth.
Bevil wheel on long drawing out shaft, 24 teeth.
Wheel on drawing out scroll shaft, 48 teeth.

(*See next page.*)

272 revolutions of twist shaft per minute.
18 teeth, back pinion on twist shaft.

2176
272

4896
19 teeth, wheel on back shaft.

44064
4896

93024
24 teeth, bevil wheel on long drawing out shaft.

372096
186048

2232576 dividend.

50 teeth, back change wheel on back shaft, for driving front rols.
61 teeth, back change wheel on long drawing out shaft.

3050
48 teeth, bevil wheel on drawing out scroll shaft.

24400
12200

146400 divisor.

146400)2232576(15,25, or 15¼ revolutions nearly,
146400 drawing out scroll per minute.

768576
732000

365760
292800

729600
732000—nearly.

If the drawing out scroll be $6\frac{3}{4}$ inches diameter, making $15\frac{1}{4}$ revolutions per minute; how many inches will the scroll, or carriage traverse?

15,25, or $15\frac{1}{4}$ revolutions of scroll per minute.
6,75, or $6\frac{3}{4}$ inches, diameter of scroll.

7625
10675
9150

102,9375
3,1416 circumference when the diameter is 1.

6176250
1029375
4117500
1029375
3088125

323,38845000, or nearly $323\frac{4}{10}$ inches, drawing out scroll traverses per minute.

The length delivered by the front rollers per stretch, is required from the following particulars?

Carriage, or drawing out scroll traverses 323,38845 inches per minute.

Front rollers traverse 307,625472 inches per minute.

Length of stretch put up, 60,5, or $60\frac{1}{2}$ inches.

307,625472 inches, front rollers traverse per min.
60,5, or $60\frac{1}{2}$ inches length of stretch.

1538127360
18457528320

18611,3410560 dividend.

(*Carried to next page.*)

Car. travs. per min. 323,38845 in.) 18611,3410560 (57,551 inches, front rollers deliver per stretch.

161694225

244191855
226371915

178199406
161694225

165051810
161694225

33575850
32338845

1237005

If the length delivered at the front rollers per stretch, be 57,551 inches, and the length of the stretch put up, be 60,5, or 60½ inches; how many inches per stretch does the carriage gain?

60,500, or 60½ inches, length of stretch put up.
57,551 inches, length deliv. at front rols. per stretch.

2,949, or nearly 3 inches, gain of carriage.

The draught between the carriage and front rollers, is required from the following particulars?

Carriage traverses, 323,38845 inches per minute.
Front rollers traverse, 307,625472 inches per minute.

307,625472) 323,388450 (1,05124 draught between carriage and front rollers.

307625472

1576297800
1538127360

381704400
307625472

740789280
615250944

1255383360
1230501888

24881472

The length of the stretch, is required from the following particulars?

Front rollers deliver, 57,551 inches per minute.

Draught between carriage and front rollers, 1,05124.

57,551 inches, front rollers deliver per minute.
1,05124 draught between carriage and front rollers.

230204
115102
57551
287755
575510

60,49991324, or 60½ inches, length of stretch.

The total draught at mules is required from the following particulars?

Draught between front and back rollers, 12,857109375.

Draught between carriage and front rollers, 1,05124.

12,857109375 draught between front and back rols.
1,05124 draught between car. and front rols.

51428437500
25714218750
12857109375
64285546875
128571093750

13,51590765937500, or rather more than 13½, total draught at mules.

The total draught at mules is required from the following particulars?

Revolutions of drawing out scroll per minute, 15,25.

Revolutions of back rollers per minute, 8,704.

Diameter of scroll, 6¾ inches, or 54-8ths.

Diameter of back rollers, ⅞ inches, or 7-8ths.

(See next page.)

15,25 revolutions of drawing out scroll per min.
54-8ths, or $6\frac{3}{4}$ inches, diameter of do.

6100
7625

823,50 dividend.

8,704 revolutions of back rollers per minute.
7-8ths, or $\frac{7}{8}$ inch, diameter of back rollers.

60,928 divisor.

Divisor. Dividend.
60,928)823,500(13,515 total draught at mules.
60928

214220
182784

314360
304640

97200
60928

362720
304640

58080

The total draught at mules, is required from the following particulars?

Bevil wheel on drawing out scroll shaft, 48 teeth.
*Bevil wheel on long drawing out shaft, 24 teeth.
Back change wheel on drawing out shaft, 61 teeth.
Wheel on back shaft, 19 teeth.
Wheel on front rollers, 20 teeth.
Crown wheel, 108 teeth.
*Change pinion, 24 teeth.
Wheel on back rollers, 50 teeth.
Diameter of drawing out scroll, $6\frac{3}{4}$ inches, or 54-8ths.
Diameter of back rollers, $\frac{7}{8}$ inch, or 7-8ths.

Driving wheels.

48 teeth, bevil wheel on drawing out scroll shaft.
61 teeth, back change wheel on drawing out shaft.

48
288

2928
20 teeth, wheel on front rollers.

58560
7-8ths inch, diameter of back rollers.

409920 divisor.

Driven wheels.
19 teeth, wheel on back shaft.
108 teeth, crown wheel.

152
190

2052
50 teeth, wheel on back rollers.

102600
54-8ths, or $6\frac{3}{4}$ in. diam. of drawing out scroll.

410400
513000

5540400 dividend.

(Continued.)

* These wheels are omitted in working, one being a driving and the other a driven wheel, each containing the same number of teeth.

409920)5540400(13,5158 total draught at mules.
409920

1441200
1229760

2114400
2049600

648000
409920

2380800
2049600

3312000
3279360

32640

N. B.—By changing the 50 *teeth wheel on the back shaft, it will affect the front rollers and drawing out scroll in the same proportion, consequently the gain, or draught at carriage will remain the same. The gain, or draught at carriage may be altered by changing the* 61 *teeth wheel on the long drawing out shaft; both being driven wheels from the first moving power, a less number of teeth will increase the speed, whereas, had they been driving wheels, it would have required a greater number of teeth to have produced an increase of speed, and the reverse for a decrease in speed.*

The speed of the quadrant shaft is required from the following particulars?

Revolutions of drawing out scroll per minute, 15,25.

Diameter of scroll, 6,75 inches.

Diameter of drum on quadrant shaft, 6,125.

15,25 revols. of drawing out scroll per minute.
6,75, or $6\frac{3}{4}$ inches, diameter of scroll.

7625
10675
9150

102,9375

(*Carried to next page.*)

Diam. of drum on quad. shaft, 6,125 in.)102,9375(16,806 revols. of
6125 quad. shaft per min.

41687
36750

49375
49000

37500
36750

750

N. B.—The quadrant shaft is driven by the drawing out scroll band while the carriage is drawing out, and the chain on the winding on drum is counterbalanced by a weight at the end of a band working on pulleys, and connected with the winding on drum, which is out of geer while drawing out, and is put into geer by a spring connected with the long lever and vertical shaft when the carriage is going in, during which time, the speed of the winding on drum is governed by a strap, working the governor wheels connected with the worm, when the slide, to which the winding on chain is affixed, rises in the recess of the quadrant by means of the worm, and decreases the length of the chain from the drum, regulating the winding on according to the increasing thickness of the cop; when the cop has attained the intended thickness, then the governor wheels cease to work, and the length of the chain going on the winding on drum, remains the same till the cop is completed.

The number of teeth the quadrant moves per stretch, is required from the following particulars ?

Carriage traverses 323,38845 inches per minute.
Revolutions of quadrant shaft per minute, 16,806.
Wheel on quadrant shaft, 22 teeth.
Length of stretch, 60½ inches.

16,806 revols. of quad. shaft per min.
22 teeth, wheel on do.

33612
33612

369,732
60,5, or 60½ inches. length of stretch.

1848660
22183920

Car. travs., 323,38845 in.)22368,7860(69,17 number of teeth quad. moves per stretch of 60½ inches.
194033070

296547900
291049605

54982950
32338845

226441050
226371915

69135

The turns per inch of yarn are required, from the following particulars?

Bell wheel worked by a worm on the twist shaft, 56 teeth.
Diameter of the grooved pulley on the twist shaft, $17\frac{3}{8}$ inches.
* Diameter of grooved twist pulley, driving vertical shaft, $10\frac{1}{4}$ in.
* Diameter of grooved pulley on the vertical shaft, $10\frac{1}{4}$ inches.
* Diameter of grooved pulley on tin drums, 10 inches.
* Diameter of tin drums, driving the spindles, 10 inches.
Diameter of wharves on the spindles, $\frac{7}{8}$ inch.
Length of stretch put up, $60\frac{1}{2}$ inches.

17,375, or $17\frac{3}{8}$ inches, diam. of grooved pul. on the twist shaft.
56 teeth, bell wheel.

104250
86875

973,000 dividend.

,875, or, 7-8ths of an inch, diam. of wharves.
60,5, or $60\frac{1}{2}$ inches, length of stretch.

4375
52500

52,9375 divisor.

52,9375)973,0000(18,38 turns per inch of yarn required.
529375

4436250
4235000

2012500
1588125

4243750
4235000

8750

* These are all omitted in the work, being driving and driven, of the same dimensions

The number of teeth in the bell wheel, is required from the following particulars?

Number of turns per inch of yarn required, 18,38.
Length of stretch put up, 60,5 inches.
Diameter of wharves on the spindles, $\frac{7}{8}$ inch.
* Diameter of drum driving wharves, 10 inches.
* Diameter of pulley on drum driving wharves, 10 inches.
Diameter of pulley on vertical shaft, $10\frac{1}{4}$ inches.
Diameter of pulley driving vertical shaft, $10\frac{1}{4}$ inches.
Diameter of pulley on twist shaft, $17\frac{3}{8}$ inches.

18,38 turns per inch.
60,5 inches, length of stretch.

9190
110280

1111,990, or 1112 turns in a stretch of $60\frac{1}{2}$ in.
,875, or $\frac{7}{8}$ inch, diam. of spindle wharves.

555995
778393
889592

Diam. of pul } inches.
on twist shft, } 17,375)972,99125(56 nearly, number of teeth required
86875 in the bell wheel.

104241
104250—nearly.

N. B.—All the rules are fully laid down in a former part of this work. (See hand mules.)

The speed of the short going in shaft, is required from the following particulars?

Revolutions of twist shaft per minute, 272.
Wheel on loose pulley, 36 teeth.
Wheel on short going in shaft, 54 teeth.

(See next page.)

* These are omitted in the work, on account of being driving and driven of the same dimensions: but if the diameters had been of different dimensions, they must have been made use of as in former examples.

272 revolutions of twist shaft per minute.
36 teeth, wheel on loose pulley.

1632
816

Wheel on short going in shaft, 54 teeth.—— 54)9792(181,33, or 181$\frac{1}{3}$ revolutions of short going in shaft per minute.

439
432

72
54

180
162

180
162

18

The speed of the long going in shaft, is required from the following particulars?

Revolutions of twist shaft per minute, 272.
Wheel on loose pulley, 36 teeth.
Wheel on short going in shaft, 54 teeth.
Wheel on short going in shaft, 17 teeth.
Wheel on long going in shaft, 20 teeth.

272 revolutions of twist shaft per minute.
36 teeth, wheel on loose pulley.

1632
816

9792
17 teeth, wheel on short going in shaft.

68544
9792

166464 dividend.

(*Continued.*)

54 teeth, wheel on short going in shaft.
20 teeth, wheel on long going in shaft.

1080 divisor.

1080)166464(154,133 revolutions of long going in shaft per minute.
1080

5846
5400

4464
4320

1440
1080

3600
3240

3600
3240

360

The speed of the going in scroll shaft, is required from the following particulars?

Revolutions of twist shaft per minute, 272.
Wheel on loose pulley, 36 teeth.
Wheel on short going in shaft, 54 teeth.
Wheel on short going in shaft, 17 teeth.
Wheel on long going in shaft, 20 teeth.
Bevil wheel on long going in shaft, 16 teeth.
Bevil wheel on scroll shaft, 45 teeth.

(See next page.)

272 revolutions of twist shaft per minute.
36 teeth, wheel on loose pulley.

1632
816

9792
17 teeth, wheel on short going in shaft.

68544
9792

166464
16 teeth, bevil wheel on long going in shaft.

998784
166464

2663424 dividend.

54 teeth, wheel on short going in shaft.
20 teeth, wheel on long going in shaft.

1080
45 teeth, bevil wheel on scroll shaft.

5400
4320

48600 divisor.

48600)2663424(54,80296 revolutions of going in scroll per minute.
243000

233424
194400

390240
388800

144000
97200

468000

468000
437400

306000
291600

14400

The revolutions of the going in scroll per stretch, are required from the following particulars?

Circumference, or chase of scroll per stretch, 22 inches.
Length of stretch put up, 60½ inches.

22)60,5(2,75, or 2¾ revolutions of going in scroll per stretch.
44
165
154
110
110

The speed of the backing off wheel, is required from the following particulars?

Revolutions of long going in shaft per minute, 154,133.
Wheel on long going in shaft, 12 teeth.
Backing off wheel, 77 teeth.

154,133 revols. of long going in shaft
12 teeth, wheel on do. [per min.

Backing off wheel, 77 teeth.)1849,600(24,02 revolutions of backing off wheel per minute.
154
309
308
160
154
6

N. B.—The backing off wheel can be regulated by the leather friction pulley, which works into the backing off wheel, and may be made slacker, or tighter, by means of a bolt and nut connected with the friction pulley. The proper friction on the backing off wheel is very essential, which will soon be ascertained by any practical person.

Required, from the following particulars, the length of time per stretch the carriage occupies while going in.

Revolutions of going in scroll per minute, 54,80296.

Revolutions of going in scroll per stretch, 2,75.

2,75 revols. of going in scroll per 60 seconds, 1 minute. [stretch.

Revols. of going in scroll per minute, 54,80296)165,00000(3,010786, or rather more than 3 seconds per stretch.

16440888

5911200
5480296

43090400
38362072

47283280
43842368

34409120
32881776

1527344

If it requires 56 turns, or revolutions of the twist shaft, to draw out one stretch; what time will it require, if the twist shaft makes 272 turns, or revolutions per minute?

272)56,0(,20588 minute per stretch.
544

1600
1360

2400
2176

2240
2176

64

,20588 minute per stretch.
60 seconds 1 minute.

12,35280 seconds required to draw out 1 stretch.

The number of stretches per mule, per minute, is required from the following particulars, allowing $2\frac{1}{2}$ seconds per stretch, for backing off?

Drawing out per stretch, 12,3528 seconds.
Backing off per stretch, 2,5 seconds.
Going in per stretch. 3,0107 seconds.

17,8635 seconds per stretch.

17,8635)60,0000(3,3588, or rather more than $3\frac{7}{8}$ stretches per minute, each mule.
535905

640950
535905

1050450
893175

1572750
1429080

1436700
1429080

7620

If a mule produces 3,3588 stretches per minute, and each stretch be 60 inches; how many hanks per spindle will be produced in one week, allowing them to work successively for 65 hours?

3,3588 stretches per minute.
60 minutes, 1 hour.

201,5280 stretches per hour.
65 hours in 1 week.

1007640
1209168

13099,320 stretches, in 1 week.
60 inches, each stretch.

785959,200 inches of yarn per spindles, per week.

(*See next page.*)

1 yard, is 36 inches. } 6)785959,2 inches of yarn per spindle per week.
6)130993,2

21832,2 yards per spindle per week.

1 hank, is 840 yds.)21832,2(25,99 nearly 26 hanks per spindle per week.
1680

5032
4200

8322
7560

7620
7560

60

The speed of the leather contact pulley, is required from the following particulars?

Revolutions of twist shaft per minute, 272.
Wheel on loose pulley, 36 teeth.
Wheel on leather contact pulley shaft, 33 teeth.

272 revolutions of twist pulley per min.
36 teeth, wheel on loose pulley.

1632
816

Wheel on leather contact pulley, 33)9792(296,727 revols. of leather contact pulley per minute.
66

319
297

222
198

240
231

90

90
66

240
231

9

If the leather contact pulley be $3\frac{3}{4}$ inches diameter, making 296,727 revolutions per minute; what will it traverse?

296,727 revols. of leather contact pulley per min.
3,75, or $3\frac{3}{4}$ inches, diameter of do

1483635
2077089
890181

1112,72625
3,1416 circumference when the diameter is 1.

667635750
111272625
445090500
111272625
333817875

3495,740787000 inches, leather contact pulley traverses per minute.

The revolutions of the spindles, for the twist shaft once, is required from the following particulars?

Revolutions of spindles per stretch, 1112.
Revolutions of twist shaft per stretch, 56.

Revols. of twist shaft per stretch, is 56, then $8 \times 7 = 56$ } 8)1112 revols. of spindles per stretch.
7)139

19,857 revols. of the spindles, for the twist shaft once.

Required, from the following particulars, the revolutions per stretch of the spindles for winding on yarn, at the beginning of the set; i. e. when the spindles are bare?

Diameter of winding on drum, $4\frac{1}{8}$, or 4,125 inches.
Length of chain thrown off drum, $60\frac{1}{2}$ or 60,5 inches.
Wheel on the winding on drum, 41 teeth.
Pinion on winding on drum shaft, 25 teeth.
* { Bevil wheel on winding on drum shaft, 40 teeth.
{ Bevil wheel on foot of vertical shaft, 40 teeth.
Diameter of pulley on vertical shaft, $10\frac{1}{4}$, or 10,25 inches.
Diameter of spindle wharves, $\frac{7}{8}$, or ,875 inch. *(See next page.)*

* These are omitted in the work, being driving and driven; and the tin drums for driving spindles are omitted, being intermediate.

4,125 inches, diameter of winding on drum.
3,1416 inches, circum. when the diam. is 1.

24750
4125
16500
4125
12375

12,9591000
25 teeth, pinion on winding on drum shaft.

647955
259182

323,9775
,875 inches, diameter of wharves.

16198875
22678425
25918200

283,4803125 divisor.

60,5 in., length of chn. thrown off wind. on drm.
41 teeth, wheel on winding on drum.

605
2420

2480,5
10,25 inches diam. of pulley on vertical shaft.

124025
49610
248050

283,4803125)25425,1250000(89,689 revols. of spindle per stretch,
22678425000 winding yarn on bare spindles.

27467000000
25513228125

19537718750
17008818750

25289000000

25289000000
22678425000

26105750000
25513228125

592521875

If it requires the bare or empty spindles to make 89,689 revolutions to wind on a stretch, 60½ inches long; what will the circumference and diameter of the spindles be?

89,689)60,5000(,67455 inch, circumference of spindles.
538134
668660
627823
408370
358756
496140
448445
476950
448445
28505

3,1416),67455(,2147 inch, diameter of spindles.
62832
46230
31416
148140
125664
224760
219912
4848

The speed of the spindles for winding on the yarn, will be in accordance with their diameter, from which may be ascertained the size of the winding on drum, or pinion on the winding on drum shaft.

If the diameter of the spindles be $\frac{1}{4}$ inch; how many revolutions must they make to wind on $60\frac{1}{2}$ inches of yarn?

3,1416 circumference when the diameter is 1.
,25, or $\frac{1}{4}$ inch, diameter of spindles.

157080
62832

,785400 circumference of spindle.

,7854)60,5000(77 revolutions required for spindle, to wind
54978 on $60\frac{1}{2}$ inches of yarn.

55220
54978

242

Required, the revolutions of the winding on drum, for the spindles to make 77 revolutions, or turns per stretch, according to the following particulars?

Diameter of spindle wharves, $\frac{7}{8}$, or ,875 inch.
Diameter of pulley on vertical shaft, $10\frac{1}{4}$ inches.
Pinion on winding on drum shaft, 25 teeth.
Wheel on winding on drum, 41 teeth.

,875 diameter of spindle wharves.
77 revols., or turns of spindles per stretch.

6125
6125

67,375
25 teeth, pinion on winding on drum shaft.

336875
134750

1684,375 dividend.

(Continued.)

10,25 inches, diameter of pulley on vertical shaft.
41 teeth, wheel on winding on drum.

1025
4100

420,25 divisor.

420,25)1684,375(4 revolutions of winding on drum per stretch required
168100

337

If the winding on drum be required to make 4 revolutions per stretch; what must the circumference be to wind on 60½ inches of chain.

4)60,5

15,125, or 15⅛ inches, circumference of drum.

If the winding on drum be 15,125, or 15⅛ inches circumference; what will the diameter be?

3,1416)15,1250(4,8144 inches, diameter of winding on drum.
125664

255860
251328

45320
31416

139040
125664

133760
125664

8096

The iron contact pulley on the cam shaft is 5$\frac{1}{16}$ inches diameter, and has 4 recesses, or spaces in it at an equal distance, which relieve it from the leather contact pulley, and is also assisted by 4 pins in the front of the escape plate, each of which works against a spring, when the spring at the back of the escape plate moves from one bolster to another when acted upon by the lever connected, and which gives power by the assistance of the leather contact pulley, to the different motions on the cam shaft which is as follows:—

(See next page.)

Motions from the escape plate.

First,—Back and front cams for the strap lever.
Second,—Backing off cam connected with the friction pulley, working into backing off wheel pulley.
Third,—Front roller eccentric.
Fourth,—Stop finger connected with the bell wheel shaft.
Fifth,—Going in eccentric.
Sixth,—Drawing out eccentric.

The following are the alternate movements on the cam shaft each stretch :—

First,—Roller geer and drawing out motions.
Second,—Twist motion.
Third,—Backing off motion.
Fourth,—Going in motion.

THE FOLLOWING ARE THE PARTICULARS OF THE SELF-ACTING MULES :—

Revolutions of twist shaft per minute, 272.
Revolutions of spindles per minute, 5401,1428.
Revolutions of vertical shaft per minute, 461,07317.
Revolutions of front rollers per minute, 97,92.
Revolutions of middle rollers per minute, 11,14112.
Revolutions of back rollers per minute, 8,704.
Revolutions of long drawing out shaft per minute, 30,499, or 30½.
Revolutions of drawing out scroll per minute, 15,249, or 15¼.
Revolutions of quadrant shaft per minute, 16,806.
Revolutions of short going in shaft per minute, 181,333.
Revolutions of long going in shaft per minute, 154,1333.
Revolutions of going in scroll per minute, 54,80296.
Revolutions of going in scroll per stretch, 2,75, or 2¾.
Revolutions of backing off wheel per minute, 24,02.
Revolutions of leather contact pulley per minute, 296,727.
Revolutions of spindles per twist shaft once, 19,857.
Revolutions of bare, or empty spindles for winding on yarn per stretch, at the beginning of set, 89,689.
Diameter of pulleys on twist shaft, 12 inches.
Diameter of grooved band pulley on twist shaft, 17⅜, 8, and 18⅜ in.
Diameter of grooved twist pulley for driving vertical shaft, 10¼ inches.
Diameter of grooved pulley on vertical shaft, 10¼ inches.

Diameter of grooved pulley on tin drums, 10 inches.
Diameter of tin drums for driving spindles, 10 inches.
Diameter of spindle wharves, $\frac{7}{8}$ inch.
Diameter of front rollers, 1 inch.
Diameter of middle rollers, $\frac{3}{4}$ inch.
Diameter of back rollers, $\frac{7}{8}$ inch.
Diameter of drawing out scroll, $6\frac{3}{4}$ inches.
Diameter of quadrant shaft drum $6\frac{1}{8}$ inches.
Diameter of leather contact pulley, $3\frac{3}{4}$ inches.
Diameter of iron contact pulley, $5\frac{11}{16}$ inches.
Diameter of winding on drum, $4\frac{1}{8}$ inches.
Diameter of spindles, ,2147 inch.

Front rollers traverse per minute, 307,625472 inches.
Middle rollers traverse per minute, 26,250707 inches.
Back rollers traverse per minute, 23,926425 inches.
Drawing out scroll traverses per minute, 323,38845 inches.
Front rollers traverse per stretch, 57,551 inches.
Carriage traverses per stretch, 60,5 inches.
Going in scroll traverses per revolution, 22 inches.
Leather contact pulley traverses per minute, 3495,749787 inches.

Draught between the middle and back rollers, 1,0971428 nearly $1\frac{1}{10}$.
Draught between the front and middle rollers, 11,71875.
Draught between the front and back rollers, 12,8571.
Draught between the front rollers and carriage, 1,05124.
Total draught at the mules, 13,5158.

Gain at carriage per stretch, 2,949, nearly 3 inches.
Turns per inch in yarn, 18,38.
Turns per stretch of $60\frac{1}{2}$ inches, 1112.
Bell wheel, 56 teeth.
Number of teeth the quadrant moves per stretch of $60\frac{1}{2}$ inches, 69,17.

Time per stretch drawing carriage out, 12,3528 seconds.
Time per stretch allowed for backing off, 2,5 seconds.
Time per stretch carriage going in, 3,0107 seconds.
Time required to complete each stretch, 17,8635 seconds.

Number of stretches per minute, per mule, 3,3588.
Number of stretches per hour, per mule, 201,528.
Number of stretches per week, per mule, 13099,32.
Number of hanks per spindle, per week, 25,99, or 26 hanks nearly.

The faller rises by the lowering of the coping rail, by means of a lever connected with the faller sector working upon it; the faller sector at the same time works into a 22 teeth wheel on the faller shaft.

The backing off eccentric is loose on the vertical shaft, and the chain attached to the eccentric, and connected with the faller sector, is governed by a catch fixed to the plate of the eccentric, working against the ratchet wheel while backing off.

N. B.—The number of teeth in the ratchet wheel is 88.

At the commencement of a set, when the spindles are bare or empty, great care must be taken to set the coping rail and winding on chain to their proper places, by means of the worm, or screw connected; for if right then, they will regulate themselves afterwards.

Whatever bevil the coping rail may have, will be the length of the chase given to the faller, which may be increased, or decreased, by giving more bevil to the coping rail, and by changing the wheel on the worm shaft connected with the shaper, or coping plate; the cop may be made larger, or smaller; a larger wheel will make a larger cop, on account of the worm shaft connected with the shaper, or coping plate, moving slower, and a smaller wheel will make a smaller cop, by the worm shaft connected with the shaper, or coping plate, moving quicker, there being a finger attached to the carriage which works the catch on the wheel of the worm shaft, and causes the wheel to move one tooth each stretch, which gives the bevil to the coping rail.

It is of the utmost importance that every attention be given to machinery, by having every part of the machine properly adjusted, and set square with the scrolls and other bands of a proper tightness; and that regular cleaning and oiling be particularly attended to, which is indispensible in all machinery; the neglect of which causes machinery to work ill, and destroys it much sooner than it otherwise would have been, had proper care been taken.

Neglect always brings the best machinery into disrepute, consequently is injurious to the best machinists, and trade generally suffers materially.

Within these last few years there have been a number of patents obtained by different machinists for improvements in machinery, used in all the different operations of carding, drawing, slabbing, roving, spinning, and weaving. The following of which are a few

The patent feeder for carding engines, which may be applied to blowing, or lap machines, is made by Messrs. Hibbert, Platt and Sons, Green Acres Moor, Oldham; Mr. F. Sleddon, Preston; and Mr. Houldsworth, Glasgow.

The patent feeder consists of a plate fixed to the framing at the back of the carding engine, in which is a dish which the feed rollers work in. The cotton passes over the first iron feed roller, which is plain, and 2 inches diameter, to the dish in which the top feed roller which is fluted, and 2 inches diameter, works, and conveys the cotton forward in the dish to the edge of the plate, which is planed straight; the cotton is so held between the roller and dish by means of a weight and lever working on the top feed roller, that the fibres of the cotton are completely laid straight by means of the licker in drawing it over the edge of the plate. The centre of the licker in must be set $\frac{7}{8}$ of an inch below the plate, or as may be found necessary, according to the staple of the cotton, so that it may not be injured.

Wherever the patent feeder has been introduced, it has given great satisfaction. The fibres of the cotton being completely laid straight, will not require more than two-thirds of the carding, consequently will produce a greater quantity and of a much stronger quality. The principal object in carding being to straighten the fibres and prepare it for drawing, too much carding has a tendency not only to weaken the staple of the cotton, but produces a number of small naps which it is impossible to clean out of the cards by stripping, consequently they pass through the different operations to the yarn, and cause the cloth to have a bad appearance.

Rollers, or bobbins, have been introduced into many factories in place of cans, where the carding and drawing are put on by means of a friction drum, on which the roller or bobbin works; the carding or drawing passing through an eye on the end of a lever which works on the roller or bobbin, and traverses from one end to the other, by means of a mangle wheel, or some other motion to the same purpose. Some of them, so constructed that the friction drum traverses, and the lever remains stationary, are made by Messrs. Else, & Co., Manchester.

Messrs. Cheetham and Hill, of Stayley-bridge, have introduced a system of pressing the carding and drawing into cans, which some prefer to that of rollers or bobbins. However, either of the systems is advantageous, there being a great diminution of labour, less waste

made at the different operations, and a superior quality of yarn produced. The carding and drawing not being so liable to break, there are less piecings, consequently they are more regular and even.

Messrs. Cheetham and Hill have recently obtained a patent for a new construction of machinery for slabbing and roving, which is likely to be of great utility.

In addition to the patent self acting mules, made by Messrs. Sharp and Roberts; Mr. Smith, of Glasgow, has a patent for self acting mules of which a number have been made with recent improvements, and appear to give much satisfaction. They are made by Mr. F. Sleddon, and Messrs. Ainscow and Tomlinson, Preston; and by Messrs. Curtis, Parr, and Madeley, Manchester.

Mr. Potter, of Manchester, is also a patentee for a new self acting mule on an extremely simple construction, of which, I have been informed, there are a number making; being highly approved of by many in the spinning business.

HANK, OR PROPORTION OF HANK, &c., IN EACH OPERATION.

The following examples will shew the hank, and the decimal, or proportion of hank, in each and every operation from the spinning to the lap machine.

Suppose the numbers, or counts of yarn be 40's, with a draught of 9,6, or $9\frac{6}{10}$; what hank roving will be required?

Draught, 9,6)40,0(4,1666, or $4\frac{1}{6}$ hank roving required.

384

160
96

640
576

640
576

640
576

64

If the draught at roving frame be 7,5, or $7\frac{1}{2}$, producing a $4\frac{1}{6}$ hank roving; what hank will the slabbing be, allowing 2 slabbings to each roving?

N. B.—Where there is doubling, multiply the hank, or proportion of hank, by the number of ends doubled, and divide by the draught.

Hank roving $4\frac{1}{6}$, or 4,1666

2, number of ends doubled.

Draught $7\frac{1}{2}$, or 7,5)8,3333(1,1111, or $1\frac{1}{9}$ hank slabbing.

75

83
75

83
75

83
75

83
75

8

If the draught at the slabbing frame be 6,875, and the slabbing be 1,1111, or $1\frac{1}{9}$ hank; what decimal, or proportion of hank will the drawing be, put up at the back of slabbing frame, there being no doubling?

Draught, 6,875)1,1111(0,1616 decimal, or proportion of hank, last head of drawing.

6875

42361
41250

11111
6875

42361
41250

1111

If 8 ends be put up at the last head of drawings, and the draught be 6,125, and the decimal of the hank 0,1616; what decimal, or proportion of hank will the drawings be that are put up?

0,1616 decimal, or proportion of hank at 8 ends doubling. [last head.

Draught, $6\frac{1}{8}$, or 6,125)1,2929(0,211 decimal, or proportion of hank at middle, or second head of drawings.
12250
6792
6125
6679
6125
554

If the hank drawing at second head be 0,211; what will the decimal, or proportion of hank be at the first head, if the draught be 6,25, and the doubling 8?

0,211 decimal, or proportion of hank at 8 ends doubling. [middle head.

Draught, $6\frac{1}{4}$, or 6, 25)1,688(0,27 decimal, or proportion of hank, at first head of drawings.
1250
4380
4375
5

If the decimal, or proportion of hank at the first head of drawings be 0,27, the draught 6,25, and the doubling 8; what decimal, or proportion of hank will the carding be?

0,27 decimal of hank at first head of drawings.
8 ends doubling.

Draught, $6\frac{1}{4}$, or 6,25)2,1600(0,3456 decimal of hank carding.
1875
2850
2500
3500
3125
3750
3750

If the decimal of the hank carding be 0,3456, and the draught at the carding engine be 130; what will the decimal of the hank lap be?

Draught at carding engine, 130)0,3456(,00265846 decimal, or proportion of hank lap.
260
856
780
760
650
1100
1040
600
520
800
780
20

N. B—The weight of any number of yards of carding, or drawing may be found in the tables, according to the decimal, or proportion of hank.

If the decimal, or proportion of the hank lap be 0,00265846, and the draught at the lap machine be 2,75, or $2\frac{3}{4}$; what will the decimal, or proportion of the hank of cotton fed on feed cloth at the lap machine be?

Draught at lap machine, 2,75)0,00265846(0,0009667 decimal of hank fed on feed cloth at lap machine.

2475

1834
1650

1846
1650

1960
1925

35

If the decimal, or proportion of hank at the lap machine be 0,0009667; what will the net weight of cotton fed on 30 inches of feed cloth at the lap machine be?

Look in the table of dividends for inches, and opposite 30 will be found 6,9444 the dividend; which divided by 0,0009667 the decimal, or proportion of hank at the lap machine, will give the net weight of cotton in grains.

Decimal of hank, 0,0009667)6,9444(7183 grains or 1lb., 0 oz., 7 dwts., 15 grains.

67669

17754
9667

80874
77336

35384
29001

6383

N. B.—The above weight being subtracted from the gross weight of cotton fed on feed cloth at lap machine, will give the weight of loss sustained in working.

LOSS IN WORKING.

Suppose there be 18½ ounces of cotton fed on the feed cloth at the lap machine, and the weight of yarn produced (as appears from the preceding example) be 1lb., 0 oz., 7 dwts., and 15 grains; what will the loss sustained in working be?

	oz.	dwts.	grains.	
18½ ounces, =	18 ..	9 ..	2¾	weight of cotton at lap machine.
	16 ..	7 ..	15	weight of yarn produced.
	2 ..	1 ..	11¾	weight lost in working.

Or,

The loss sustained in working any kind of cotton may be found in the following manner.

Multiply all the draughts together successively for a divisor, and all the doublings together accordingly, and that product by the numbers of yarn produced for a dividend, and the quotient will be the decimal, or proportion of the hank.

Then look for the dividend in the table opposite the number of inches any given weight of cotton is fed on the feed cloth at the lap machine, and divide by the decimal, or proportion of the hank, and the quotient will be the net weight in grains; which, subtracted from the weight of cotton fed on the feed cloth at the lap machine, will shew the loss sustained in working.

The loss sustained in each operation, may be ascertained in the same manner.

Suppose the draughts and doubling are as follows :—the numbers to be spun 40's, and the weight of cotton fed on 30 inches of feed cloth at the lap machine be 18½ ounces; what will be the loss in working?

Draught at lap machine, 2,75.
Draught at carding engine, 130.
Draught at 1st head drawing, 6,25.
Draught at 2nd head drawing, 6,25.
Draught at 3rd head drawing, 6,125.
Draught at slabbing frame, 6,875.
Draught at roving frame, 7.5.
Draught at mules, 9,6

Doubling 1st head drawing, 8.
Doubling 2nd head drawing, 8.
Doubling 3rd head drawing, 8.
Doubling roving frame, 2.

Draughts.
2,75 lap machine.
130 carding engine.

8250
275

357,50
6¼ draught at 1st head drawing.

2145,0
89375

2234,375
6¼ draught at 2nd head drawing.

13406,250
55859375

13964,84375
6⅛ draught at 3rd head drawing.

83789,06250
174560546875

85534,66796875 total draught from lap machine to the last head of drawings.

(*Continued.*)

Draughts continued. 85534,66796875

6,875 draught at slabbing frame.

42767333984375
59874267578125
68427734375000
51320800781250

588050,84228515625

7,5 draught at roving frame.

294025421142578125
411635589599609375

4410381,317138671875

9,6 draught at mules.

26462287902832031250
39693431854248046875

Divisor 42339660,6445312500000 total draughts.

8 doubling 1st head drawing.
8 doubling 2nd head drawing.

64
8 doubling 3rd head drawing.

512
2 doubling roving frame.

1024 total doubling.
40's numbers spun.

Dividend 40960

(Continued.)

42339660,64453125)40960,000000000000(0,0009674 decimal, or
38105694580078125 proportion of hank
at lap machine.

28543054199218750
25403796386718750

31392578125000000
29637762451171875

1754156738281250
1693586425781250

612292480468750

The dividend for 30 inches is 6,9444, which, divided by 0,0009674 the decimal, or proportion of the hank at the lap machine, will give the weight of yarn in grains produced; which, subtracted from the 18½ ounces of cotton fed on the feed cloth at the lap machine, will shew the loss sustained in working.

Dec., or prop. of hank, 0,0009674)6,9444(7178 grains, or 16 oz., 7 dwts., 10 grains of yarn produced from 18½ oz. of cotton.
67718

17264
9674

75904
67718

81864
77392

4472

	oz.	dwts.	grains.
Cotton consumed at lap machine,	18	9	2¾
Yarns produced,	16	7	10
Loss sustained in working,	2	1	16¾

The weight of cotton fed on any given length of feed cloth at the lap machine reduced to grains, may be divided by the draughts, and multiplied by the doublings successively, through each operation; which will shew the gross weight in grains for the same length, as the given length of feed cloth at the lap machine, which may be extended to any length, the weight being in proportion.

The net weight of the same length according to the hank or proportion of hank in the same operation, being subtracted from the gross weight, will shew the loss sustained at each operation, or the whole loss throughout the different processes of working.

N. B.—Proceed with the same particulars as in the last examples.

If there be $18\frac{1}{2}$ ounces of cotton fed on 30 inches of feed cloth at the lap machine; what weight should the same length weigh at the different processes, (allowing no loss,) if the draughts and doubling be as follows:—

Draughts.

Lap machine, 2,75, or $2\frac{3}{4}$
Carding engine, 130.
1st head of drawings, 6,25, or $6\frac{1}{4}$.
2nd head of drawings, 6,25, or $6\frac{1}{4}$.
3rd head of drawings, 6,125, or $6\frac{1}{8}$.
Slabbing frame, 6,875, or $6\frac{7}{8}$.
Roving frame, 7,5, or $7\frac{1}{2}$.
Mules, 9,6, or $9\frac{6}{10}$.

Doubling.

1st head of drawings, 8.
2nd head of drawings, 8.
3rd head of drawings, 8.
Roving frame, 2.

(Continued.)

Reduce 18½ ounces to grains for the dividend.

437,5 grains = 1 oz.
18,5, or 18½ ounces of cotton fed on feed cloth.

21875
35000
4375

Draught at lap mac. 2,75)8093,75(2943,2 grains, or 6 oz., 13 dwts.
550 6¼ grains, weight of 30 in. of lap.

2593
2475

1187
1100

875
825

500
550—nearly.

2943,2 grains, weight of 30 inches of lap; draught at the carding engine 130.

130)2943,2(22,64 grains, weight of 30 inches of carding.
260

343
260

832
780

520
520

(Continued.)

22,64 grains, weight of 30 inches of carding; draught at the 1st head of drawings 6,25, and doubling 8.

22,64 grains, weight of carding.
8 ends, doubling at 1st head of drawings.

Draught, 6,25)181,12(28,9792 grains, or 1 dwt., 4,9792 grains, weight of 30 inches of drawing at the 1st head.
1250
5612
5000
6120
5625
4950
4375
5750
5625
1250
1250

28,9792 grns, weight of drwg. 1st head.
8 ends doubling.

Draught at 2nd head of drawings, 6,25)231,8336(37,093 grains, or 1 dwt., 13,093 grains, weight of 30 inches of drawing 2nd head.
1875
4433
4375
5836
5625
2110
1875
235

(Continued.)

37,093 grains, weight of 30 inches of drawing at 2nd head; draught at 3rd head of drawings 6,125, and doubling 8.

37,093 grains, weight of 30 inches of drawing.
8 ends doubling.

Drght. at 3rd head of drwg. 6,125)296,746(48,448 grains, or 2 dwts., 0,448 grains, weight of 30 inches of drawing at the third head.

24500
51746
49000
27460
24500
29600
24500
51000
49000
2000

48,448 grains, weight of 30 inches of drawing at 3rd, or last head; draught at slabbing frame 6,875, (no doubling.)

Draught at slabbing frame, 6,875)48,448(7,04698 grains, weight of 30 inches of slabbing.

48125
32300
27500
48000
41250
67500
61875
56250
55000
1250

(*Continued.*)

7,04698 grns, weight of 30 in. of slabbing.
2 ends doubling at roving frame.

Drght. at rov. frame, 7,5)14,09396(1,88 grains, weight of 30 inches of roving.
75
659
600
593
600—nearly.

1,88 grains, weight of 30 inches of roving; draught at mules 9,6, (no doubling.)

Draught at mules, 9,5)1,88(0,195833 decimal of a grain, weight of 30 inches of yarn.
96
920
864
560
480
800
768
320
288
320
288
32

(Continued.)

0,195833 grain, weight of 30 inches of yarn.
144, the number of 30 inches in 1 lea,
or 120 yards.

783333
783333
195833

28,200000 grains, weight of 1 lea.
25 grains, weight of 1 lea of 40's yarn.

3,2, or 3½ grains, loss in working 1 lea.
7 leas, 1 hank.

22,4 grains, loss in working 1 hank.
40 hanks, 1lb.

grains.
1 oz. is equal to 437,5)896,0(2 oz., 0 dwts., 21 grains, loss sustained in working 1lb.
8750

21,0

When 30 inches of feed cloth is the length, any given weight of cotton is fed on at the lap machine; the table on the next page will shew the multipliers for any number of yards weighed at any operation.

The number of grains in any operation, multiplied by the figures opposite the number of yards weighed, will give the gross weight; from which subtract the net weight. The difference will be the loss sustained in working the length weighed.

TABLE OF MULTIPLIERS.

For ascertaining the loss sustained in working any given length, or weight of cotton yarn, as 1 lea, 1 nank, or 1lb., as shewn in a preceding example.

Length weighed.	Multipliers.
Yards.	
1	1,2
2	2,4
3	3,6
4	4,8
5	6
6	7,2
7	8,4
8	9,6
9	10,8
10	12
20	24
30	36
40	48
50	60
60	72
70	84
80	96
90	108
100	120
110	132
1 lea, or 120	144
Leas.	
2	288
3	432
4	576
5	720
6	864
1 hank, or 7	1008

N. B.—Where 30 *inches is the length any given weight of cotton is fed on the feed cloth at lap machine, (which is nearly general,) the above multipliers answer without exception.*

The proportion of the hank, and the weight of any given length will be sufficiently explained in the foregoing rules, examples, and illustrations. However, it will not be out of place to give one or two more; as nothing in calculations is more essential to masters or managers.

According to a former example 30 inches of roving weighs 1,88 grains, (but no person can weigh to so great a nicety.) I wish to know what 30 yards of the same roving will weigh, and what hank it is?

1,88 grains, weight of 30 inches of roving.
36 multiplier for 30 yards, (see table.)

1128
564

67,68 grains, or 2 dwts., 19,68 grains, weight of 30 yards of roving.

250 is the dividend for 30 yards, which divided by the number of grains it weighs, will give the hank roving.

grains. Dividend.
Weight of 30 yards, 67,68)250,00(3,693, or $3\frac{7}{10}$ hank roving nearly.
20304

46960
40608

53520
60912

26080
20304

5776

If the hank roving when weighed be $4\frac{1}{6}$, or 4,166 hanks; what will be the loss sustained in working 30 yards?

250 is the dividend for 30 yards, which divided by 4,166, the hank roving, will give the number of grains net weight.

Hank roving, =4,166)250,000(60 grains, net weight of 30 yards, of
25000 $4\frac{1}{6}$ hank roving.

N. B.—For loss sustained in working see next example.

If the weight of cotton required for 30 yards of roving be 67,68 grains, and the weight of the same length of roving be 60 grains, which is equal to 4,166, or 4¼ hanks; what will the loss sustained in working be for 1 lea, 1 hank, and 1lb.

67,68 grains, weight of cot. reqd. for 30 yds. of rov.
60 grains, weight of 30 yards of roving.

7,68 grains, loss at 30 yards.
4 times 30 is equal to 120 yards, or 1 lea.

30,72 grains, loss at 1 lea.
7 leas, 1 hank.

215,04 grains, loss at 1 hank.
4,166 hank roving produced.

129026
129026
21504
86016

895,85686 grains, loss sustained in working 1lb. of cotton.

Or,

1 oz. is equal to 437,5 grns.)895,85686(2,0477 ounces,
8750 — 437½ grains are 1 oz.

20856 — 3339
17500 — 1431
1908
33568 — 238
30625

20,8687 grains, or 2 oz.
29436 — 0 dwts., 21 grains
30625—nearly. — nearly.

AVERAGE COP AND WEIGHT OF SETS.

To find the numbers of yarn, and the number of hanks in one set of cops, (from an average cop,) the weight of the set being given.

RULE.—Multiply the length on one cop, by the number of spindles in the wheels, for the number of hanks in the set; then divide by the weight of the set, and the quotient will be the numbers of yarn.

If a set of cops from a pair of wheels containing 808 spindles, weighs 30 lbs., and the length on one cop be 1 hank, 6 leas, and 70 threads; what number of hanks will there be in the set, and what numbers of yarn will it be?

	Hank.	Leas.	Threads.	
One cop contains,	1 ..	6 ..	70	
			10 x 10 x 8 add 8 = 808 spdls.	
	19 ..	5 ..	60	
			10	
	198 ..	1 ..	40	
			8	
	1585 ..	5 ..	0	
	15 ..	6 ..	0 = 8	
Wght. of sets 3,0 lbs)	160,1 ..	4 ..	0 No. of hanks on 1 set.	
	53,4 nearly, hanks fineness of Nos. of yarn.			

Or,

Reduce the length on one cop to threads, and multiply by the number of spindles in the wheels; then divide by the number of threads in one lea, the quotient of which must be divided by the number of leas in one hank, and that quotient will be the number of hanks contained in the set; then the number of hanks contained in the set must be divided by the weight of set, and the quotient will be the number of hanks in 1 lb.

Hank. Leas. Threads.
One cop contains, 1 .. 6 .. 70
7 leas, 1 hank.

13
80 threads, 1 lea.

1110 threads on one cop.
808 spindles in the pair of wheels.

8880
88800

1 lea, 8,0 thrds.)89688,0 threads on 1 pair of sets.

1 hank, 7 leas.)11211 leas on 1 pair of sets.

1601,5714 hanks on 1 pair of sets.
7 leas, 1 hank.

3,9998 leas.
80 threads, 1 lea.

79,9840 threads.

The length of yarn on one pair of sets will be 1601 hanks, 4 leas.
Weight of set, 3,0 lbs.)160,1,5714 hanks on one pair of sets.

53,3857, or rather more than 53¼ nos. of yarn.

What will one set of cops weigh, if the wheels contain 808 spindles, the numbers of yarn 53 hanks to the pound, the number of stretches 1000, and the length of the stretch put up 60 inches?

Multiply the number of stretches, the length of stretch, and the number of spindles in the wheels together respectively for a dividend; then multiply the numbers of yarn by 840 and 36 respectively for a divisor, and the quotient will be the weight of the set.

1000, number of stretches on one cop.
60 inches, length of stretch.

60000
808 number of spindles in wheels.

48480000 dividend.

840 yards, 1 hank.
36 inches, 1 yard.

5040
2520

30240 inches in 1 hank.
53, numbers of yarn.

90720
151200

1602720 divisor.

1602720)48480000(30 lbs., 3¼ oz., weight of set.
4808160

398400
16 ounces, 1 lb.

2390400
398400

1602720)6374400(3 ounces.
4808160

1566240
4 qrs., 1 ounce.

1602720)6264960(3 qrs.
4808160

1456800

What will the weight of one pin, or shuttle cop of 36's weft be, containing 450 stretches, each stretch 57 inches net, (allowed for breakage.)

450, number of stretches on cop.
57 inches, length of stretch.

3150
2250

1 yard is 36 inches.)25650(712,5 yards.
252

45
36

90
72

180
180

1 lea is 120 yards.)712,5(5,9375 leas on 1 cop.
600

1125
1080

450
360

900
840

600
600

(Continued.)

Leas.
Nos. of weft, 36's)5,937,5(164,93 grains, or 6 dwts, 20,93 grains,
36 weight on 1 cop.

233
216

177
144

335
324

110
108

2

How many leas and threads are there in one cop, containing 712½ yards?

1 lea is 120 yds.)712,5(5 leas, 75 threads, on 1 cop.
600

1½ yards is one thread, 1,5)112,5(75 threads.
105

75
75

N. B.—In ascertaining the weight of one cop, reckon your dividend as many thousands as you have leas, and where the decimal of a lea occurs, which is generally the case, put the point in, reserving the thousands, which, divided by the numbers of yarn, will give the weight of the cop in grains.

What will one cop of 36's twist weigh, containing 900 stretches, each stretch 61½ inches, exclusive of breakage?

900, number of stretches.
61,5 or 61½ inches, length of stretch.

1 yard is 36 inches. } 6)55350,0
6)9225

1 lea is 12,0 yards.)153,7,5 yards on 1 cop.

12,8125 leas on 1 cop.

(Continued.)

Nos. of yarn, 36)12812,5(355,9 grains, or 14 dwts, 19,9 grains, weight of 1 cop.

108

201
180

212
180

325
324

1

What will one cop of 48's twist weigh; if it contains 1200 stretches, each stretch to put up 61 inches, exclusive of breakage?

1200, number of stretches.
61 inches, length of stretch.

1200
7200

1 yard is 36 inches. } 6)73200 inches on 1 cop.
6)12200

1 lea is 12,0 yards)203,3,3 yards on 1 cop.

16,944 leas, or 2 hanks, 2,944 leas on 1 cop.

Nos. of yarn, 48 } Leas.
4)16,944,
12)4236

353, grains, or 14 dwts., 17 grains, weight of 1 cop.

WEIGHT OF SETS.

The number of hanks, and weight of a pair of sets of cops, are required from the following particulars?

Number of spindles, 1008.
Number of stretches, 900,
Length of stretches, 61½ inches.
Numbers of yarn, 36 hanks to 1 lb.

1008 number of spindles in mules.
900, number of stretches.

907200
61,5, or 61½ inches, length of stretch.

4536000
907200
5443200

55792800,0 inches of yarn on 1 pair of sets.

1 yard is 36 inches.)55792800(1549800 yards on 1 set of cops.
36
197
180
179
144
352
324
288
288

(Continued.)

1 lea is 12,0 yds.)154980,0 yards on 1 set of cops.

1 hank is 7 leas.)12915 leas on 1 set of cops.

Nos. of yarn,36. } 6)1845 hanks on 1 set of cops.
6)307,5

51,25 lbs., or 51 lbs., 4 oz., weight of set.
16 ounces 1 lb.

150
25

4,00 ounces.

The number of hanks in a pair of sets of cops, is required from the following particulars?

Number of spindles in mules, 1340.
Number of stretches, 1200.
Length of stretches, 59,5 inches.

1340 spindles in mules.
1200 stretches.

1608000
59,5, or 59½ inches, length of stretch.

8040
14472
8040

1 yd. is 36. in. } 6)95676000,0 yards of yarn on 1 set of cops.
6)15946000

1 lea is 12,0 yds.)265766,6,6 yards of yarn on 1 set of cops.

1 hank is 7 leas.)22147,222 leas of yarn on 1 set of cops.

3163,888 hanks of yarn on 1 set of cops.
7 leas, 1 hank.

6,222 leas.
120 yards, 1 lea.

26,666 yards.

SPINNER'S BOOK, &c.

Where it is customary to pay the spinners at the rate of so much per thousand hanks, the length of the average cop from each set may be put down for the week; then add them together and multiply by the number of spindles in the mules, as follows:—

No. of spindles	Weight of sets.		Average cop.		
in mules.	lbs.	oz.	hanks.	leas.	threads.
1008	51	8	1	5	65
,,	50	4	1	4	72
,,	52	6	1	6	36
,,	51	12	1	5	60
,,	51	10	1	5	14
,,	52	8	1	6	10
,,	52	4	1	5	32
,,	51	12	1	5	64
,,	52	4	1	6	38
,,	52	8	1	6	14
,,	51	0	1	5	0
,,	50	4	1	4	18
Total for 1 week.	620	0	21	4	23

Hanks. Leas. Threads.
21 .. 4 .. 23
7 leas, 1 hank.

151
80 threads, 1 lea.

12103
1008 spindles in mules

96824
1210300

Threads in 1 lea, 8$_{4}^{0}$)1219982$_{4}$ threads.

1 hank is 7 leas.)152497..64, or 152497 leas, 64 threads.

21785..2..64, or 21785 hanks, 2 leas, 64 threads, number of hanks on 1 pair of sets of cops.

Total weight, 620lbs)21785(35$\frac{1}{8}$ hanks, average number of yarns.
1860

3185
3100

85

The number of hanks per spindle will be ascertained, by dividing the number of hanks spun, by the number of spindles in the mules, or throstles.

If the total number of hanks spun in a week be 21745, and the number of spindles in the mules be 1005; what number of hanks per spindle will be produced?

1005)21745(21,5724, or 21 hanks, 4 leas per spindle.
2016 7 leas, 1 hank.

1555 4,0005 leas.
1005 120 yards, 1 lea.

5770 ,5160
5040

7300
7056

2440
2016

4240
4032

208

The spinner's book should be made up so that the weight, numbers of yarn, the total number of hanks, and the number of hanks per spindle per week, would appear at one view, for the satisfaction of the employers, and the government of the managers.

THE FOLLOWING FORM MIGHT BE ADOPTED.

Date. 1830.	Name.	Weight. lbs.	Number	Total number of hanks.	No. of hanks per spindle.	Rate.	£. s. d.
April 17	John Pollard	620	35⅛	21745	21,5724	⅝	2 8 11

N. B.—The form of the book may be altered according to the system of spinning and paying, but the above particulars should always appear.

DRESSING MACHINE.

Dressing machines are of various constructions, and, like most other machines, have been greatly improved; however, the necessary calculations will be easily ascertained from the following examples.

The speed of the crank shaft, on which is fixed the top, or large cone drum, is required from the following particulars?

Revolutions of driving shaft per minute, 66.
Diameter of drum on shaft, 18 inches.
Diameter of pulley on crank shaft, 17½ inches.

66 revolutions of driving shaft per min.
18, diameter of drum on do.

528
66

Diam. of pulley on crank shaft, inches. 17,5)1188(67,885714 revolutions of crank shaft per minute, on which is fixed the top, or large cone drum.

1050

1380
1225

1550
1400

1500
1400

1000
875

1250
1225

250
175

750
700

50

The speed of the fan at dressing machine, is required from the following particulars?

Revolutions of crank shaft per minute, 67,885714.
Diameter of pulley on crank shaft for driving fan, 25 inches.
Diameter of pulley on the end of fan, 2 inches.

67,885714 revcls. of crank shaft per min.
25 in., diam. of pul. on crank shaft.

339428570
135771428

Diam. of pulley on the end of fan, } in. 2)1697,142850

848,571425 revolutions of fan per minute.

The speed of the fan at dressing machine, is required from the following particulars?

Revolutions of driving shaft per minute, 66.
Diameter of drum on shaft, 18 inches.
Diameter of drum on crank shaft, 17½ inches.
Diameter of pulley on crank shaft for driving fan, 25 inches.
Diameter of pulley on end of fan, 2 inches.

66 revolutions of driving shaft per min.
18 inches, diam. of drum on driving shaft.

528
66

1188
25 inches, diam. of pulley on crank shaft for driving fan.

5940
2376

29700 dividend.

17,5 inches, diameter of pulley on crank shaft.
2 inches, diameter of pulley on end of fan.

35,0 divisor.

35 { 5)29700
7)5940

848,571428 revolutions of fan per minute.

If the fan of a dressing machine makes 848,571428 revolutions per minute, and its diameter is 18 inches; how many yards will it traverse per minute?

848,571428 revolutions of fan per minute.
1,5 foot, = 18 in. diam. of fan.

4242857140
848571428

1272,8571420
3,1416 circum. when the diam is 1.

7637142852
1272857142
5091428568
1272857142
3818571426

1 yard = 3 feet)3998,8079973072 feet, fan traverses per minute.

1332,93566576906 yards, fan traverses per min.

The fan of a dressing machine, (as in the above example,) will traverse a space equal to 1333 yards nearly.

The speed of the under cone drum, is required from the following particulars?

Revolutions of crank, or top cone drum shaft, 67,885714 per minute.
Diameter of top cone drum, 11¾ inches.
Diameter of bottom cone drum, 4¾ inches.

67,885714 revols. of top cone drum shaft per min.
11,75, or 11¾ inches, diam of top cone drum.

339428570
475199998
746742854

797,65713950 dividend.

(Continued.)

Diam. of under cone drum, 4,75 in.)797,6571395(167,9278 revols. of under cone drum per min.

475

3226
2850

3765
3325

4407
4275

1321
950

3713
3325

3889
3800

89

N. B.—The preceding example shews the greatest speed that the under cone drum can work; the largest diameter of the top cone, and the smallest diameter of the under cone being given, i. e., the greatest speed that can be given to the motions connected with the top beam on which the dressed yarn is.

The speed of the top beam can be regulated by a worm, or screw shaft, which works the strap on the drums, and must be done according to the heat, or drying, and fineness of yarns.

The speed of the top, or dressed yarn beam, is required from the following particulars?

Revolutions of under cone shaft per minute, 167,9278.
Wheel on the end of cone shaft, 74 teeth.
Wheel on foot of upright shaft, 44 teeth.
Single worm on top of upright shaft.
Wheel on shaft for working top beam, 68 teeth.

(See next page.)

167,9278 revols. of under cone drum per min.
74 teeth wheel on the end of do

6717112
11754946

12426,6572 dividend.

44 teeth, wheel on foot of upright shaft.
68 teeth, wheel on shaft for working top beam.

352
264

2992 divisor.

2992)12426,6572(4,1533 revols. per min. of top, or
11968 dressed yarn beam, at the bottom
or beginning.

4586
2992

15945
14960

9857
8976

8812
8976—nearly.

N. B.—The top, or dressed yarn beam, decreases in speed as it fills, continuing to traverse over the same surface as at the commencement, so that the yarn is dried regularly.

If the heat, or drying increases, or decreases, which is sometimes the case, then the top, or dressed yarn beam, must be regulated in speed accordingly, which will be done by moving the strap on the cone drums by the worm, or screw attached for that purpose.

PARTICULARS OF DRESSING FRAME.

Revolutions per minute of crank, or top cone drum shaft, 67,885714.

Revolutions of fan per minute, 848,571425.

Revolutions of under cone per minute, at the bottom of beam, 167,9287.

Revolutions of top, or dressed yarn beam per minute, at the bottom of beam, 4,1533.

Diameter of pulley on crank, or top cone drum shaft, 17½ inches.

Diameter of pulley on crank, or top cone drum shaft for driving fan, 25 inches.

Diameter of pulley on end of fan, 2 inches.

Diameter of fan, 18 inches.

Diameters of top cone drum, 11¾ and 6 inches.

Diameters of under cone drum, 10½ and 4¾ inches.

Radius of crank for brushes, 3 inches.

Radius of crank for leverage, 1¾ inch.

Traversing of fan per minute, 1333 yards, nearly.

N. B.—The dimensions of the cone drums are the two extremes.

What number of ends must there be on each twist beam, allowing 8 beams to a machine, i. e. 4 beams to each side, to produce a piece of cloth 29½ inches wide, in a 72 reed, Manchester and Stockport count?

29,5, width of warp at the end.
72 reed, Manchester & Stockport count.

590
2065

Number of beams, 8)2124,0 total number of ends in the warp.

265,5 number of ends on each beam.

N. B.—The number of ends required for each beam is 265,5, *which may be made into* 266, *and make* 2 *twisters, or double ends at the selvage, at each side of the machine.*

What number of ends will it require to produce a top, or dressed yarn beam, to fill 51½ inches in a 84 reed, Manchester and Stockport count; and what number of ends must there be on each twist beam, allowing 8 twist beams to a machine?

51,5 in., width of top, or dressed yarn beam at reed.
84 reed, Manchester and Stockport count.

2060
4120

Num. of bms. 8)4326,0 number of ends in dressed yarn beam.

540,75 number of ends required on each twist beam.

N. B.—Add as many ends as are required, according to the number of double ends wanted at the selvages.

If there be 542 ends on a twist beam, and 8 beams to a machine; how many ends will there be in the dressed yarn or top beam?

542 ends on each twist beam.
8 beams to a machine.

4336 ends on dressed yarn, or top beam.

N. B.—The bell wheel at the dressing machine must be regulated according to the size of your under roller, and length of piece required.

There has been a patent obtained very recently by Messrs. William Henry Hornby, and William Kenworthy, spinners and manufacturers, of Brookhouse, near Blackburn, for an improved apparatus for sizing cotton, linen, worsted, and other fibrous substances, which is likely to supersede dressing, particularly for low and medium numbers of yarns.

POWER LOOM.

The number of picks per minute, is required from the following particulars?

Revolutions of driving shaft per minute, 102.
Diameter of drum on driving shaft, 14 inches.
Diameter of pulley on loom, 11 inches.

102 revols. of driving shaft per min.
14 in. diam. of drum on same shaft.

408
102

Diam. of pul. on loom, 11 in.)1428

129,818 number of picks per min.

If the crank shaft of a loom makes 129,818 revolutions per minute, with a wheel 50 teeth fixed on the end, working into a wheel with 100 teeth on the end of the tappet shaft; what number of revolutions will the tappet shaft make per minute?

129,818 revolutions of crank shaft per min.
50 teeth on end of crank shaft.

Teeth on end of tappet shaft, 100)6490,900

64,909 revolutions per minute of tapt. shaft.

N. B.—The above examples only refer to plain cloths, but the calculations of twills, fustians, and all other fancy goods, are regulated by the number or different constructions of the tappets working upon the treadles, or levers, connected with the healds, whereby nearly any pattern may be constructed and manufactured as by hand weaving.

The number of picks per minute, is required from the following particulars?

Revolutions of driving shaft per minute, 98,25.
Diameter of drum on driving shaft, 15,5 inches.
Diameter of pulley on crank shaft, 12,75 inches.

(See next page.)

98,25 revolutions of driving shaft per minute.
15,5, or $15\frac{1}{2}$ in. diam. of drum on driving shaft.

49125
49125
9825

1522,875 dividend.

Diam. of pul. on crank shaft, $12\frac{3}{4}$ in. } inches. 12,75)1522,875(119,441 revolutions of crank shaft per minute.

1275

2478
1275

12037
11475

5625
5100

5250
5100

1500
1275

225

The speed of the tappet shaft is required from the following particulars?

Revolutions of crank shaft per minute, 119,441.
Wheel on end of crank shaft, 50 teeth,
Wheel on end of tappet shaft, 100 teeth.

119,441 revols. of crank shaft per min.
50 teeth, wheel on crank shaft.

Wheel on tapt. shaft, 100 tth.)5972,050

59,7205 revolutions of tappet shaft per minute.

If the crank shaft of a power loom makes 129,818 revolutions, i. e. picks per minute; what time will it be required to work successively, to produce a piece of cloth 29 yards long, with 88 picks, or threads in 1 inch?

29 yards, length of piece.
37 inches, length hooked for 1 yard.

203
87

1073 number of inches in 1 pick.
88 number of picks in 1 inch.

8584
8584

Dividend 94424 total number of picks in 1 piece, 29 yards long.

Num. of picks per min., 129,818)94424,00(727,3567 mins. required to work successively, to produce 1 piece of cloth, 29 yards long, or 12 hours, 7 mins., 21,402 seconds.

908726
355140
259636
955040
908726
463140
389454
736860
649090
877700
778908
987920
908726
79194

The length of time required for the loom to work successively, to produce 1 piece of cloth 29 yards long with 88 picks, or threads in 1 inch, will be 12 hours, 7 minutes, and 21 seconds.

N. B.—The distance of the hooks on all frames for hooking pieces is 37 *inches.*

If the crank shaft of a power loom makes 119,441 revolutions per minute, i. e. so many picks or threads; what length of time must it work successively, to produce a piece of cloth 29 yards long with 84 picks, or threads in 1 inch?

29 yards, length of piece.
37 inches, length hooked for 1 yard.

203
87

1073 number of inches in 1 piece of cloth.
84 number of picks or threads in 1 inch.

4292
8584

Dividend 90132 number of picks in 1 piece of cloth 29 yards long.

Num. of picks per min., 119,441)90132,0(754,615 minutes, or
836087 60)754,615

652330 12..34..615
597205 60s.1m.

551250 36,900
477764

734860
716646

182140
119441

626990
597205

29785

The length of time required for the loom to work successively, to produce a piece of cloth of the foregoing description, will be 12 hours, 34 minutes, 37 seconds, nearly.

The weight of yarn is required, to make 1 piece of cloth, of the following description?

Length of piece, 29 yards.
Count of reed, 72. (Manchester and Stockport count.)
Numbers of twist, 36's.
Width of warp at the reed, 29½ inches.
Number of picks in 1 inch, 88.
Numbers of weft, 36's.

29 yards, length of piece.
72, Manchester and Stockport count of reed.

58
203

2088
29½ inches, width of warp at the reed.

18792
4176
1044

1 hank is 840 yards,)61596(73,328 hanks of twist required for the piece.
5880

2796
2520

2760
2520

2400
1680

7200
6720

480

(Continued.)

29 yards, length of piece.
88 picks, or threads in 1 inch.

232
232

2552
29,5, or 29½ inches, width at the reed.

12760
22968
5104

75284,0

1 hank is 840 yards.)75284,0(89,624 hanks of weft required for the piece.
6720

8084
7560

5240
5040

2000
1680

3200
3360—nearly.

73,328 hanks of twist.
89,624 hanks of weft.

Numbers of yarn, 36 { 6)162,952 hanks of yarn required for 1 piece.

6)27,158

4,526 lbs. of yarn.
16 oz., 1 lb.

3156
526

8,416 ounces.
4 qrs. 1 ounce.

1,664 qrs.

The weight of yarn required for the piece, is 4lbs. 8½ oz., nearly.

Or,

When the numbers of twist and weft are the same, the question may be worked in one operation, by adding the Manchester or Stockport count of reed, and the number of picks, or threads required in the inch together, and then proceed as in either of the last examples. *Thus,*

72, Manchester or Stockport count of reed.
88 picks, or threads in 1 inch.

160
29 yards, length of piece.

1440
320

4640
29,5 inches, width at the reed.

23200
41760
9280

136880,0 dividend.

Yards in 1 hank, 840
Numbers of yarn, 36

5040
2520

Yards in 1lb., 30240)136880,0(4,526 lbs. of yarn.
120960

159200
151200

80000
60480

195200
181440

13760

The weight of yarn required for the piece, is 4 lbs., 8½ oz, nearly, as in the last example.

THE DRIVING AND DRIVEN WHEELS REQUIRED TO PRODUCE ANY GIVEN DRAUGHT BETWEEN THE MIDDLE AND BACK ROLLERS, AND BETWEEN THE BACK AND FRONT ROLLERS, THE DIAMETER OF THE ROLLERS BEING GIVEN.

WHEELS REQUIRED TO PRODUCE ANY GIVEN DRAUGHT FOR BACK AND MIDDLE ROLLERS.

RULE.—Multiply the length you intend drawing, by the diameter of the middle roller, for the driving wheel; and the length you wish that drawn into, by the diameter of the back roller, for the driven wheel.

If a greater or less number of teeth be required in the wheel, divide the driver and driven wheels by any number that will divide both without a remainder; then multiply the quotients by any number, according to the number of teeth wanted in the wheels.

N. B.—The diameter of the wheels will be according to the pitch of the teeth.

What number of teeth must there be in the wheel required, for the back and middle rollers to produce a draught of 1 into 2, allowing the back roller to be $\frac{7}{8}$ inch, and middle roller 1 inch in diameter?

	1 into 2 draught	
Middle roller 1 inch, or	8	7, or $\frac{7}{8}$ inch back roller.
Divided by	2)8	14
Quotients	4 and	7
Multipliers	5	5
Mid. rol., driving wheel	20 tth.	35 teeth, driven wheel.

Required the draught between the middle and back rollers, from the following particulars?

Wheel on middle roller, (driving wheel,) 20 teeth.
Wheel on back roller, (driven wheel,) 35 teeth.
Diameter of middle roller, 1 inch.
Diameter of back roller, $\frac{7}{8}$ inch.

	Driving wheel.	Driven wheel.
Diam. of back rol., $\frac{7}{8}$ in.	20 teeth.	35 teeth.
	7	1 inch, or 8, diameter of middle rol.
	140	140)280(2, or 1 into 2 draught,
		280 between middle and
		back rollers.

What number of teeth must there be in the wheels on the back and middle rollers, to produce a draught equal to 2 into 3, if the back roller be $\frac{7}{8}$ inch, and the middle roller 1 inch in diameter?

2 into 3 draught,

Middle roller, 1 inch, or	8	7, or $\frac{7}{8}$ inch back roller.
Middle roller wheel,	16	21 wheel on back roller.
	2	2
Middle roller wheel,	32 tth.	42 teeth, wheel on back roller.

The draught between the middle and back rollers, is required from the following particulars?

	Driving wheel.	Driven wheel.
	16 teeth.	21 teeth.
Diameter of back roller,	7	8, or 1 inch diam. of mid. roller.
	112	)168(1,5, or 2 into 3 draught.
		112
		560
		560

Or,

	Driving wheel.	Driven wheel.
	32 teeth.	42 teeth.
Diameter of back roller,	7	8, or 1 in. diam. of mid. rol.
	224	)336(1,5, or 2 into 3 draught.
		224
		1120
		1120

What number of teeth must there be in the wheels on the back and middle rollers, to produce a draught equal to 3 into 4, if the back and middle rollers be the same diameters?

3 into 4 draught.

7 7

Middle roller wheel, 21 tth. 28 teeth, back roller wheel.

The draught between the middle and back roller, is required from the following particulars, the diameters of the rollers being the same?

Driving wheel. Driven wheel.

21 21)28(1$\frac{1}{3}$, or 3 into 4 draught.

21

7

$\frac{7}{21} = \frac{1}{3}$

The wheels for the back and middle rollers are required to produce a draught of 3 into 4, the diameter of the back roller being 1 inch, and the middle roller 1$\frac{1}{8}$ or $\frac{9}{8}$ inch diameter?

3 into 4 draught.

Middle roller, $\frac{9}{8}$ inch 9 8, or 1 inch back roller.

27 tth. 32 teeth, wheel for back roller.

The draught between the middle and back rollers, is required from the following particulars?

Wheel on middle roller, 27 teeth. Diam. of middle roller, 1$\frac{1}{8}$ inch.

Wheel on back roller, 32 teeth. Diameter of back roller, 1 inch.

Driving wheel. Driven wheel.

27 teeth. 32 teeth.

Back roller 1 inch, or 8 9, or 1$\frac{1}{8}$ inch, middle roller.

216)288(1$\frac{1}{3}$, or 3 into 4 draught.

216

72

$\frac{72}{216} = \frac{1}{3}$

What wheels will be required to produce a draught of 4 into 5, between the middle and back rollers, if the back roller be $\frac{7}{8}$ inch, and the middle roller 1 inch diameter?

4 into 5 draught.
Middle roller, 1 inch, or 8 7, or $\frac{7}{8}$ inch back roller.
Middle roller wheel, 32 tth. 35 teeth, wheel back roller.

The draught between the back and middle rollers, is required from the following particulars?

Wheel on middle roller, 32 teeth. Diameter of middle roller, 1 inch.
Wheel on back roller, 35 teeth. Diameter of back roller, $\frac{7}{8}$ inch.

Driving wheel. Driven wheel.
32 teeth. 35 teeth.
Back roller, $\frac{7}{8}$ inch, or 7 8, or 1 inch, middle roller.

224)280(1,25, or 4 into 5 draught,
224
560
448
1120
1120

What wheels will be required to produce a draught of 5 into 6, between the middle and back rollers, if the back roller be $\frac{7}{8}$ inch and the middle roller 1 inch diameter?

5 into 6 draught.
Mid. rollers, 1 inch, or 8 7, or $\frac{7}{8}$ inch, back roller.
Divide by 2)40 tth. 42 teeth, wheel back roller.
or
Middle roller wheel, 20 tth. 21 teeth, wheel back roller.

The draught between the middle and back rollers, is required from the following particulars?

Driving wheel. Driven wheel.
40 teeth. 42 teeth.
Back roller, $\frac{7}{8}$ inch, or 7 8, or 1 inch, middle roller.

280)336(1,2 or 5 into 6 draught.
280

560
560

N. B.—The wheels may be reduced to 20 *and* 21, *and the draught will be the same.*

What wheels will be required to produce a draught of 6 into 7, between the middle and back rollers, if the back roller be $\frac{7}{8}$ inch and the middle roller 1 inch diameter?

6 into 7 draught.
Middle roller 1 inch or 8 7, or $\frac{7}{8}$ inch back roller.

Middle roller wheel, 48 tth. 49 teeth, wheel on back roller.

If there be a wheel 48 teeth on the middle roller, working into a wheel 49 teeth on the back roller, and the back roller be $\frac{7}{8}$ inch, and the middle roller 1 inch diameter; what will the draught be?

Driving wheel. Driven wheel.
48 teeth. 49 teeth.
Back roller, $\frac{7}{8}$ inch, or 7 8, or 1 inch middle roller.

336)392($1\frac{1}{6}$, or 6 into 7 draught.
336

$\frac{56}{336} = \frac{1}{6}$

What wheels will it require to produce a draught between the middle and back rollers of 7 into 8, if the back roller be $\frac{7}{8}$ inch, and the middle roller 1 inch diameter?

7 into 8 draught.

Middle roller, 1 inch, or 8 — 7, or $\frac{7}{8}$ inch back roller.

Divided by 8) 56 — 56

Lowest number 7 — 7 lowest number.

3 — 3

Middle roller wheel 21 tth. — 21 teeth, wheel back roller.

The draught between the middle and back rollers, is required from the following particulars.

Wheel on the middle roller 21 teeth, working into wheel on stud 40 teeth, which works wheel 21 teeth on back roller.

Diameter of the middle roller 1 inch, and diameter of the back roller $\frac{7}{8}$ inch.

Driving wheel. Driven wheel.

21 teeth. 21 teeth.

Back roller, $\frac{7}{8}$ inch 7 — 8, or 1 inch, middle roller.

147)168(1$\frac{1}{7}$, or 7 into 8 draught.

147

21

$= \frac{1}{7}$

147

What wheels will be required for the middle and back rollers, to produce a draught of 7 into 8; allowing the back and middle rollers to be the same diameters?

7 into 8 draught.

2 — 2

Middle roller wheel, 14 tth. — 16 teeth, wheel back roller.

Or,

(See next page.)

7 into 8
3 3

Middle roller wheel, 21 tth. 24 teeth, wheel back roller.

Or,

7 into 8
4 4

Middle roller wheel, 28 tth. 32 teeth, wheel back roller.

The draught between the middle and back rollers, is required from the particulars in the last example?

Driving wheel. Driven wheel.
teeth.
14 teeth.)16(1$\frac{2}{7}$, or 7 into 8 draught.
14
2
— or $\frac{1}{7}$.
14

21 teeth.)24(1$\frac{3}{7}$, or 7 into 8 draught.
21
3
— or $\frac{1}{7}$.
21

28 teeth.)32(1$\frac{4}{7}$, or 7 into 8 draught.
28
4
— or $\frac{1}{7}$.
28

What wheels must there be on the middle and back rollers, to produce a draught of 8 into 9, if the back roller be $\frac{7}{8}$ inch, and the middle roller $\frac{3}{4}$ inch diameter?

8 into 9 draught.
Middle roller, $\frac{3}{4}$ inch, or 6 7, or $\frac{7}{8}$ inch, back roller.

Middle roller wheel, 3)48 tth. 63 teeth, back roller wheel.

Middle roller wheel, 16 tth. 21 teeth, back roller wheel.
2 2

Middle roller wheel, 32 tth. 42 teeth, back roller wheel.

The draught between the middle and back rollers, is required from the following particulars?

Driving wheel. Driven wheel.

Wheel on middle roller, 32 teeth. 42 teeth, wheel on back roller.

7 6

224)252(1$\frac{1}{8}$, or 8 into 9 draught.

224

28

28 or $\frac{1}{8}$.

224

What wheels will be required to produce a draught of 9 into 10, between the middle and back rollers, allowing the back and middle rollers to be the same diameter?

9 into 10 draught.

2 2

Wheel on middle roller, 18 tth. 20 teeth, wheel on back roller.

Or,

9 into 10

3 3

Wheel on middle roller, 27 tth. 30 teeth, wheel on back roller.

Or,

9 into 10

4 4

Wheel on middle roller, 36 tth. 40 teeth, wheel on back roller.

If there be a wheel 40 teeth on back roller, and a wheel 36 teeth on middle roller; what draught will there be if the middle and back rollers are the same diameter?

teeth.

Wheel on middle roller, 36 teeth.)40(1$\frac{1}{9}$ or 9 into 10 draught.

36

4

4 or $\frac{1}{9}$.

36

If the back roller be 1 inch, and the middle roller $\frac{7}{8}$ inch diameter; what wheels will be required to produce a draught of 9 into 10, between the middle and back rollers?

9 into 10

Middle roller, $\frac{7}{8}$ inch, or 7 8, or 1 inch, back roller.

Middle roller wheel, 63 tth. 80 teeth, wheel back roller.

The draught between the middle and back rollers, is required from the following particulars?

Wheel on middle roller, 63 teeth. Wheel on back roller, 80 teeth.

Diameter of middle roller, $\frac{7}{8}$ inch. Diameter of back roller, 1 inch.

Driving wheel. Driven wheel.

63 teeth. 80 teeth.

Back roller, 1 inch, or 8 7, or $\frac{7}{8}$ inch middle roller.

504)560(1, $\frac{1}{9}$ or 9 into 10 draught.

504

56

$\frac{56}{504} = \frac{1}{9}$.

If the back roller be $\frac{7}{8}$ inch, and the middle roller $\frac{3}{4}$ inch diameter; what wheels will be required to produce a draught of 10 into 11, between the middle and back rollers?

10 into 11

Middle roller, $\frac{3}{4}$ inch, or 6 7, or $\frac{7}{8}$ inch, back roller.

Middle roller wheel, 60 tth. 77 teeth, wheel on back roller.

Or,

If the back and middle rollers were the same diameter.

10 inch 11

2 2

Middle roller wheel, 20 tth. 22 teeth, wheel on back roller.

Or,

10 into 11

3 3

Middle roller wheel, 30 tth. 33 teeth, wheel on back roller.

If the wheel on the back roller be 77, and the wheel on the middle roller 60, and the back roller $\frac{7}{8}$ inch, and the middle roller $\frac{3}{4}$ inch diameter, required the draught?

Driving wheel.	Driven wheel.
60 teeth.	77 teeth.
Back roller, $\frac{7}{8}$ inch, 7	6, or $\frac{3}{4}$ inch, middle roller.
420	)462(1,1, or 10 into 11 draught.
	420
	420
	420

TOTAL DRAUGHT IN ROLLERS.

RULE.—Multiply the diameter of the front roller by any number that will produce a wheel of a sufficient diameter for the first driving; then multiply the diameter of the back roller by twice the number the front roller is multiplied by for the first driven wheel, which will produce a draught equal to 2. If a draught of 3 be required, multiply the diameter of the back roller by 3 times the number by which the front roller is multiplied; if any intermediate draught between the whole numbers be required, as $2\frac{1}{8}$, $2\frac{1}{4}$, or $2\frac{1}{2}$, add to the product in proportion; and if above 3 of a draught be required, proceed accordingly.

The first driving and driven wheels being ascertained, divide the total draught required by the draught produced; the quotient of which, multiplied by the second driving wheel, will give the second driven wheel; if more wheels are required, they will be found in the same way.

N. B.—The second driving, or change wheel may contain any number of teeth, according to the diameter required.

If larger or smaller wheels be required, they may be increased, or decreased, in proportion to each other, i. e., the driving and driven wheels must be multiplied, or divided by the same number.

If the back roller be 1 inch, and the front roller $1\frac{1}{8}$ inch diameter; what wheels will be required to produce a draught of 6?

Diameter of front roller, 9, or $1\frac{1}{8}$ inches.

3

First driving wheel, 27 teeth.

Diameter of back roller, 8, or 1 inch.

$3 \times 2 = 6$

First driven wheel, 48 teeth.

	Driving wheel. 27 teeth.	Driven wheel. 48 teeth.
Back roller, 1 inch, or 8		9, or $1\frac{1}{8}$ inch, front roller.
	216	)432(2 draught.
		432

2)6 total draught.

3

2nd dvng. or change whl., 24 teeth.

2nd driven wheel, 72 teeth.

The draught is required from the following particulars?

Driving wheels, 27, and 24. Driven wheels, 48, and 72.

Diameter of back roller, 1 inch, and front roller, $1\frac{1}{8}$, or $\frac{9}{8}$ inch.

	Driving wheels. 27 teeth. 24 teeth.	Driven wheels. 48 teeth. 72 teeth.
	108	96
	54	336
	648	3456
Diam. back rol., 1 inch, or 8		9, or $1\frac{1}{8}$ inch, diam. front rol.
	5184	)31104(6 draught required.
		31104

Note.—Speeds, draughts, &c., may be wrought with fewer figures by the following method of cancelling, viz., place all the driven wheels and the diameter of the front rollers as numerators, and all the driving wheels and the diameter of the back rollers as denominators; then proceed by dividing with any number that will divide both numerator and denominator without any remainder, and the results of the numerators multiplied together for a dividend, and the results of the denominators for a divisor, and the quotient will be the answer required.

If the driving wheels are 27, and 24, and the diameter of the back roller 1 inch, and the driven wheels are 48, and 72, and the diameter of the front roller $1\frac{1}{8}$ inch; what will the draught be?

$$\frac{6 \quad 3}{48 \times 72 \times 9} \quad 6 \text{ or } 6 \text{ draught.}$$
$$\frac{}{27 \quad 24 \quad 8} = \frac{}{1}$$
$$9$$

If the back roller be $\frac{7}{8}$ inch, and the front roller 1 inch diameter; what wheels will be required to produce a draught of $5\frac{1}{2}$?

Diameter of front roller, 8, or 1 inch.

3

First driving wheel 24 teeth.

Diameter of the back roller 7, or $\frac{7}{8}$ inch.

$3 \times 2 = 6$

First driven wheel, 42 teeth.

Driving wheel.	Driven wheel.
24 teeth.	42 teeth.
Back roller, $\frac{7}{8}$ inch, or 7	8, or 1 inch, front roller.
168	)336(2 draught.
	336

(Continued.)

2)5,5 total draught.

2,75

2nd driving, or change wheel, 28 teeth.

2200
550

2nd driven wheel 77,00 teeth.

If the driving wheels be 24, and 28, the diameter of the back roller $\frac{7}{8}$ inch, and the driven wheels 42, and 77, and the diameter of the front roller 1 inch, what will the draught be?

Driving wheels.	Driven wheels.
24 teeth.	42 teeth.
28 teeth.	77 teeth.
192	294
48	294
672	3234

Back roller, $\frac{7}{8}$ inch, or 7 8, or 1 inch, front roller.

4704)25872(5,5, or $5\frac{1}{2}$ draught.
23520

23520
23520

If the back roller be $\frac{7}{8}$ inch, and the front roller 1 inch diameter; what wheels will be required to produce a draught of $2\frac{1}{2}$ in the first driving and driven wheels, and a total draught of 7?

Diameter of front roller, 8, or 1 inch.
3

First driving wheel, 24 teeth.

(Continued.)

Diameter of back roller, 7, or $\frac{7}{8}$ inch.
3 x 2=6

42
Add 21 divided by 3=7

First driven wheel, 49 teeth.

Driving wheel.	Driven wheel.
24 teeth.	49 teeth.
Back roller, $\frac{7}{8}$ inch, or 7	8, or 1 inch, front roller.
168	)392(2$\frac{1}{3}$ draught.
	336
	56
	$\frac{56}{168}=\frac{1}{3}$.

2$\frac{1}{3}$ draught. 7, total draught.
3 3
7 7)21
3
21 second driving, or change wheel.
63 second driven wheel.

If the driving wheels be 24, and 21, and the driven wheels 49, and 63, the back roller $\frac{7}{8}$ inch, and the front roller 1 inch diameter; what will the draught be?

Driving wheels.	Driven wheels.
24 teeth.	49 teeth.
21 teeth.	63 teeth
24	147
48	294
504	3087
Back roller, $\frac{7}{8}$ inch, or 7	8, or 1 inch, front roller.
3528	)24696(7 draught.
	24696

If the diameter of the front roller be $1\frac{1}{8}$ inch, and the back roller 1 inch; what wheels will be required to produce a draught of $4\frac{1}{2}$?

Diameter of the front roller, 9, or $1\frac{1}{8}$ inch.

2

First driving wheel, 18 teeth.

Diameter of back roller, 8, or 1 inch.

$2 \times 2 = 4$

First driven wheel, 32 teeth.

Driving wheel.	Driven wheel.
18 teeth.	32 teeth.
Back roller, 1 inch, or 8	9, or $1\frac{1}{8}$ inch, front roller.
144	)288(2 draught.
	288

2)4,5 total draught.

2,25

2nd driving wheel, 28 teeth.

1800

·450

2nd driven, 63, teeth.

The draught in rollers is required, when the driving wheels are 18, and 28, and the driven wheels 32, and 63, and the diameter of the back roller 1 inch, and front roller $1\frac{1}{8}$ inch.

(See next page.)

Driving wheels. Driven wheels.
18 teeth. 32 teeth.

28 63

144 96
36 192

504 2016

Back roller, 1 inch, or 8 9, or $1\frac{1}{8}$ inch front roller.

4032)18144(4,5, or $4\frac{1}{2}$ draught.
16128

20160
20160

What wheels will be required to produce $7\frac{1}{2}$ draught, if the back roller be 1 inch diameter, and the front roller $1\frac{1}{8}$ inch?

Diameter of front roller, $1\frac{1}{8}$ inch, = 9
3

First driving wheel, 27 teeth.

Diameter of back roller, 1 inch, or 8
3 x 2 = 6

48
Add 24 divided by 2 for one-half = 12

First driven wheel, 60 teeth.

(Continued.)

Driving wheel.	Driven wheel.
27 teeth.	60 teeth
Diam. of back rol, 1 inch, or 8	9, or $1\frac{1}{8}$ in. diam, of front rol.
216	)540(2,5, or $2\frac{1}{2}$ draught.
	432
	1080
	1080

$7\frac{1}{2}$ is the total draught required, which must be divided by $2\frac{1}{2}$ the first draught; the quotient of which multiplied by the second driving, or change wheel, will give the second driven wheel.

Thus,

2,5)7,5(3 multiplied by wheel 26 teeth, will
75 be equal to 78 teeth, wheel 2nd
— driven.

The draught in rollers, is required from the following particulars? Driving wheels, 27, and 26 teeth. Driven wheels, 60, and 78 teeth. Back roller, 1 inch diameter; and front roller, $1\frac{1}{8}$ inch.

Driving wheels.	Driven wheels.
27 teeth.	60 teeth.
26 teeth.	78 teeth.
162	4680
54	9, or $1\frac{1}{8}$ inch, front rol.
702	42120 dividend.
Bk. rol. 1 in., or 8	
5616 divisor.	

(Continued.)

5616)42120(7,5, or 7½ draught.
39312

28080
28080

Or,

BY CANCELLING.

$$\frac{15}{27}\cdot\frac{3}{9}\cdot\frac{60}{26}\cdot\frac{78}{8}\cdot\frac{9}{2}=\frac{15}{2}=7\tfrac{1}{2}\text{ draught.}$$

If the diameter of the front roller be 1 inch, and the back roller ⅞ inch; what wheels will be required to produce a draught of 8?

Diameter of front roller, 1 inch, or 8
3

First driving wheel, 24 teeth.

Diameter of back roller, ⅞ inch, or 7
3 x 2=6

First driven wheel, 42 teeth.

Driving wheel. Driven wheel.
24 teeth. 42 teeth.
Back roller, ⅞ inch, or 7 8, or 1 inch, front roller.

168)336(2nd draught.
336

2)8 total draught.

4

2nd driving wheel, 20 teeth.

2nd driven wheel, 80 teeth.

If the driving wheels be 24, and 30, and the driven wheels 42, and 80, the back roller $\frac{7}{8}$ inch diameter, and the front roller 1 inch; what will the draught be?

Driving wheels. Driven wheels.
24 teeth. 42 teeth.
20 teeth. 80 teeth.

480 3360

Diam. of bk. rol., $\frac{7}{8}$ in., or 7 8, or 1 inch diam. of front roller.

3360)26880(8 draught at rollers.
26880

If the diameter of the back roller be $\frac{7}{8}$ inch, and the front roller 1 inch; what wheels will be required to produce a draught of 9, i. e. 1 into 9?

Diameter of front roller, 8, or 1 inch.
3

1st driving wheel, 24 teeth.

Diameter of back roller, 7, or $\frac{7}{8}$ inch.
3 x 2=6

42
Add 21 divided by 3 =7

1st driven wheel, 49 teeth.

Driving wheel. Driven wheel.
24 teeth. 49 teeth.
Back rollers, $\frac{7}{8}$ inch, or 7 8, or 1 inch front roller.

168)392(2$\frac{1}{3}$ draught.
336

56
$\frac{56}{168} = \frac{1}{3}$.

2$\frac{1}{3}$ draught. 9 total draught.
3 3

7 7)27

3$\frac{6}{7}$

2nd driving wheel, 21 teeth.

2nd driven wheel, 81 teeth.

The draught in rollers, is required from the following particulars? Driving wheels, 24, and 21 teeth. Diameter of back roller, $\frac{7}{8}$ inch. Driven wheels, 49, and 81 teeth. Diameter of front roller, 1 inch.

Driving wheels.	Driven wheels.
24 teeth.	49 teeth.
21 teeth.	81 teeth.
24	49
48	392
504	3969
Back roller, $\frac{7}{8}$ inch, or 7	8, or 1 inch, front roller.
3528	)31752(9 draught.
	31752

If the diameter of the back roller be 1 inch, and the front roller $1\frac{1}{8}$ inch; what wheels will be required to produce a draught of $2\frac{1}{4}$, between the first driving and driven wheels, and a total draught of 8,4375?

Diameter of front roller, 9, or $1\frac{1}{8}$ inch.
3

1st driving wheel, 27 teeth.

Diameter of back roller, 8, or 1 inch.
$8 \times 2 = 6$

48
Add 24 divided by 4 $= 6$

1st driven wheel, 54 teeth.

Driving wheels.	Driven wheels.
27 teeth.	54 teeth.
Diam. back rol., 1 inch, $= 8$	9, or $1\frac{1}{8}$ inch, front roller.
Divisor 216	486 dividend.

(Continued.)

216)486(2,25, or $2\frac{1}{4}$ draught, between the first
432 driving and driven wheels.

540
432

1080
1080

Draught required.
1st draught, 2,25)8,4375(3,75 = 2nd draught.
675

1687
1575

1125
1125

3,75, 2nd draught.
2nd driving, or change wheel, 24 teeth.

1500
750

90,00 2nd driven wheel, 90 teeth.

The draught in rollers, is required from the following particulars? Driving wheels, 27, and 24 teeth. Diameter of back roller, 1 inch. Driven wheels 54, and 90 teeth. Diameter of front roller, $1\frac{1}{8}$ inch.

Driving wheels. Driven wheels.
27 teeth. 54 teeth.
24 teeth. 90 teeth.

108 4860
54 9, or $1\frac{1}{8}$ inch, front roller.

648 43740 dividend.
Back rollers, 1 inch, or 8

5184 divisor.

(Continued.)

Driving wheels.	Driven wheels.
24 teeth.	56 teeth.
22 teeth.	88 teeth.
48	448
48	448
528	4928

Back roller, $\frac{7}{8}$ inch, or 7 8, or 1 inch, front roller.

3696)39424(10,66, or $10\frac{2}{3}$, draught between back and front rollers of the throstle.

3696

24640
22176

24640
22176

2464

EXPLANATION TO THE REED TABLE.

1. Manchester and Stockport count by the number of ends in 1 inch.
2. Bolton counts by the number of beers on 24¼ inches, 20 dents to a beer.
3. Blackburn counts by the number of beers on 45 inches, 20 dents to a beer.
4. 6-4ths Preston counts by the number of beers on 58 inches, 20 dents to a beer.
5. 9-8ths Preston counts by the number of beers on 44 inches, 20 dents to a beer.
6. 4-4ths Preston counts by the number of beers on 39 inches, 20 dents to a beer.
7. 7-8ths Preston counts by the number of beers on 34 inches, 20 dents to a beer.
8. Nankeen counts by the number of beers on 20 inches, 19 dents to a beer.
9. Scotch and Carlisle count by the number of dents on 37 inches.
10. Silk counts by the number of ends on 36 inches.
11. Number of dents in 1 yard.

The first line in each division is the number of dents in 1 inch; opposite to which is the count of the reed, according to the system of counting.

N. B.—A dent is generally called a split in Scotland; a beer is generally called a porter in Scotland.

Bleached or finished goods generally decrease in width about 10 per cent.

REED TABLE.

1		2		3		4		5	
Manchester & Stockport.		Bolton.		Blackburn.		6-4ths Preston.		9-8ths Preston.	
N. of dts in 1 in.	count of reed.	N. of dts in 1 in.	count of reed.	N. of dts in 1 in.	count of reed.	N. of dts in 1 in.	count of reed.	N. of dts in 1 in.	count of reed.
15	30	15	18,187	15	33,75	15	43,5	15	33,
16	32	16	19,4	16	36,	16	46,4	16	35,2
17	34	17	20,612	17	38,25	17	49,3	17	37,4
18	36	18	21,825	18	40,5	18	52,2	18	39,6
19	38	19	23,037	19	42,75	19	55,1	19	41,8
20	40	20	24,25	20	45,	20	58,	20	44,
21	42	21	25,462	21	47,25	21	60,9	21	46,2
22	44	22	26,675	22	49,5	22	63,8	22	48,4
23	46	23	27,887	23	51,75	23	66,7	23	50,6
24	48	24	29,1	24	54,	24	69,6	24	52,8
25	50	25	30,31	25	56,25	25	72,5	25	55,
26	52	26	31,52	26	58,5	26	75,4	26	57,2
27	54	27	32,73	27	60,75	27	78,3	27	59,4
28	56	28	33,95	28	63,	28	81,2	28	61,6
29	58	29	35,16	29	65,25	29	84,1	29	63,8
30	60	30	36,87	30	67,5	30	87,	30	66,
31	62	31	37,58	31	69,75	31	89,9	31	68,2
32	64	32	38,8	32	72,	32	92,8	32	70,4
33	66	33	40,1	33	74,25	33	95,7	33	72,6
34	68	34	41,22	34	76,5	34	98,6	34	74,8
35	70	35	42,43	35	78,75	35	101,5	35	77,
36	72	36	43,65	36	81,	36	104,4	36	79,2
37	74	37	44,86	37	83,25	37	107,3	37	81,4
38	76	38	46,07	38	85,5	38	110,2	38	83,6
39	78	39	47,28	39	87,75	39	113,1	39	85,8
40	80	40	48,5	40	90,	40	116,	40	88,
41	82	41	49,71	41	92,25	41	118,9	41	90,2
42	84	42	50,9	42	94,5	42	121,8	42	92,4
43	86	43	52,13	43	96,75	43	124,7	43	94,6
44	88	44	53,35	44	99,	44	127,6	44	96,8

REED TABLE.

6		7		8		9		10		11
4-4ths Preston.		7-8ths. Preston.		Nankeen.		Scotch & Carlisle.		Silk.		
N. of dts in 1 in.	count of reed.	N. of dts in 1 in.	count of reed.	N. of dts in 1 in.	count of reed.	N. of dts in 1 in.	cnt. of reed.	N. of dts in 1 in.	cnt. of reed.	N. of dents in 1 yard.
15	29,25	15	25,5	15	15,79	15	555	15	1080	540
16	31,2	16	27,2	16	16,842	16	592	16	1152	576
17	33,15	17	28,9	17	17,894	17	629	17	1224	612
18	35,1	18	30,6	18	18,947	18	666	18	1296	648
19	37,05	19	32,3	19	20,	19	703	19	1368	684
20	39,	20	34,	20	21,052	20	740	20	1440	720
21	40,95	21	35,7	21	22,105	21	777	21	1512	756
22	42,9	22	37,4	22	23,157	22	814	22	1584	792
23	44,85	23	39,1	23	24,21	23	851	23	1656	828
24	46,8	24	40,8	24	25,26	24	888	24	1728	864
25	48,75	25	42,5	25	26,31	25	925	25	1800	900
26	50,7	26	44,2	26	27,36	26	962	26	1872	936
27	52,65	27	45,9	27	28,42	27	999	27	1944	972
28	54,6	28	47,6	28	29,47	28	1036	28	2016	1008
29	56,55	29	49,3	29	30,52	29	1073	29	2088	1044
30	58,5	30	51,	30	31,57	30	1110	30	2160	1080
31	60,45	31	52,7	31	32,63	31	1147	31	2232	1116
32	62,4	32	54,4	32	33,68	32	1184	32	2304	1152
33	64,35	33	56,1	33	34,73	33	1221	33	2376	1188
34	66,3	34	57,8	34	35,79	34	1258	34	2448	1224
35	68,25	35	59,5	35	36,84	35	1295	35	2520	1260
36	70,2	36	61,2	36	37,89	36	1332	36	2592	1296
37	72,15	37	62,9	37	38,94	37	1369	37	2664	1332
38	74,1	38	64,6	38	40,	38	1406	38	2736	1368
39	76,05	39	66,3	39	41,05	39	1443	39	2808	1404
40	78,	40	68,	40	42,1	40	1480	40	2880	1440
41	79,95	41	69,7	41	43,15	41	1517	41	2952	1476
42	81,9	42	71,4	42	44,21	42	1554	42	3024	1512
43	83,85	43	73,1	43	45,26	43	1591	43	3096	1548
44	85,8	44	74,8	44	46,31	44	1628	44	3168	1584

THE DIFFERENT SYSTEMS OF COUNTING REEDS.

If there be 21 dents in an inch; what count of reed will it be in Manchester or Stockport?

21 dents in an inch.
2 ends in a dent.

42 count of reed.

If there be 26 dents in an inch; what count of reed will it be in Bolton, allowing 20 dents to a beer.

24,25 inches.
26 dents in an inch.

14550
4850

Dents in a beer, 2,0)63,0,50

31,525 count of reed.

If there be 26 dents in an inch; what count of reed will it be in Bolton, allowing 19 dents to a beer?

24,25 inches.
26 dents in an inch.

14550
4850

Dents in a beer, 19)630,50(33,1842 count of reed.
57

60
57

35
19

160
152

80
76

40
38

2

Suppose a reed contains 33 dents in 1 inch; what count will it be according to the different systems of counting?

MANCHESTER AND STOCKPORT.

Multiply the number of dents in 1 inch by 2, and the product will be the count of the reed.

33 number of dents in 1 inch.
2 ends in a dent.

66 count of reed.

BOLTON COUNT, 20 DENTS TO A BEER.

Multiply 24¼ by the number of dents in 1 inch, and divide by 20 and the quotient will be the count of the reed.

24,25 inches.
33 number of dents in 1 inch.

7275
7275

Number of dents in a beer, 2,0)80,0,25

40,0125 count of reed.

BOLTON COUNT, 19 DENTS TO A BEER.

Multiply 24¼ by the number of dents in 1 inch, and divide by 19, and the quotient will be the count of the reed.

24,25 inches.
33 dents in 1 inch.

7275
7275

Dents in a beer, 19)800,25(42,12 count of reed.
76

40
38

22
19

35
38—nearly.

N. B.—Some kinds of goods manufactured in Bolton, reckon 19 dents to a beer

REED TABLE.

1		2		3		4		5	
Manchester & Stockport.		Bolton.		Blackburn.		6-4ths Preston.		6-4ths Preston.	
N. of dts in 1 in.	count of reed.	N. of dts in 1 in.	count of reed.	N. of dts in 1 in.	count of reed.	N. of dts in 1 in.	count of reed.	N. of dts in 1 in.	count of reed.
45	90	45	54,56	45	101,25	45	130,5	45	99,
46	92	46	55,71	46	103,5	46	133,4	46	101,2
47	94	47	56,98	47	105,75	47	136,3	47	103,4
48	96	48	58,2	48	108,	48	139,2	48	105,6
49	98	49	59,41	49	110,25	49	142,1	49	107,8
50	100	50	60,62	50	112,5	50	145,	50	110,
51	102	51	61,83	51	114,75	51	148,9	51	112,2
52	104	52	63,04	52	117,	52	151,8	52	114,4
53	106	53	64,25	53	119,25	53	154,7	53	116,6
54	108	54	65,46	54	121,5	54	157,6	54	118,8
55	110	55	66,687	55	123,75	55	159,5	55	121,
56	112	56	67,9	56	126,	56	162,4	56	123,2
57	114	57	69,112	57	128,25	57	165,3	57	125,4
58	116	58	70,325	58	130,5	58	168,2	58	127,6
59	118	59	71,537	59	132,75	59	171,1	59	129,8
60	120	60	72,75	60	135,	60	174,	60	132,
61	122	61	73,962	61	137,25	61	176,9	61	134,2
62	124	62	75,175	62	139,5	62	179,8	62	136,4
63	126	63	76,387	63	141,75	63	182,7	63	138,6
64	128	64	77,6	64	144,	64	185,6	64	140,8
65	130	65	78,812	65	146,25	65	188,5	65	143,
66	132	66	80,025	66	148,5	66	191,4	66	145,2
67	134	67	81,237	67	150,75	67	194,3	67	147,4
68	136	68	82,45	68	153,	68	197,2	68	149,6
69	138	69	83,662	69	155,25	69	200,1	69	151,8
70	140	70	84,875	70	157,5	70	203,	70	154,
71	142	71	86,087	71	159,75	71	205,9	71	156,2
72	144	72	87,3	72	162,	72	208,8	72	158,4
73	146	73	88,512	73	164,25	73	211,7	73	160,6
74	148	74	89,725	74	166,5	74	214,6	74	162,8

REED TABLE.

6		7		8		9		10		11
4-4ths Preston.		7-8ths Preston.		Nankeen.		Scotch. & Carlisle.		Silk.		
N. of dts in 1 in.	count of reed.	N. of dts in 1 in.	count of reed.	N. of dts in 1 in.	count of reed.	N. of dts in 1 in.	cnt. of reed.	N. of dts in 1 in.	cnt. of reed.	N. of dents in 1 yard
45	87,75	45	76,5	45	47,36	45	1665	45	3240	1620
46	89,7	46	78,2	46	48,42	46	1702	46	3312	1656
47	91,65	47	79,9	47	49,47	47	1739	47	3384	1692
48	93,6	48	81,6	48	50,52	48	1776	48	3456	1728
49	95,55	49	83,3	49	51,57	49	1813	49	3528	1764
50	97,5	50	85,	50	52,63	50	1850	50	3600	1800
51	99,45	51	86,7	51	53,67	51	1887	51	3672	1836
52	101,4	52	88,4	52	54,72	52	1924	52	3744	1872
53	103,35	53	90,1	53	55,78	53	1961	53	3816	1908
54	105,3	54	91,8	54	56,84	54	1998	54	3888	1944
55	107,25	55	93,5	55	57,894	55	2035	55	3960	1980
56	109,2	56	95,2	56	58,947	56	2072	56	4032	2016
57	111,15	57	96,9	57	60,	57	2109	57	4104	2052
58	113,1	58	98,6	58	61,052	58	2146	58	4176	2088
59	115,05	59	100,3	59	62,105	59	2183	59	4248	2124
60	117,	60	102,	60	63,158	60	2220	60	4320	2160
61	118,95	61	103,7	61	64,21	61	2257	61	4392	2196
62	120,9	62	105,4	62	65,263	62	2294	62	4464	2232
63	122,85	63	107,1	63	66,316	63	2331	63	4536	2268
64	124,8	64	108,8	64	67,368	64	2368	64	4608	2304
65	126,75	65	110,5	65	68,421	65	2405	65	4680	2340
66	128,7	66	112,2	66	69,473	66	2442	66	4752	2376
67	130,65	67	113,9	67	70,526	67	2479	67	4824	2412
68	132,6	68	115,6	68	71,579	68	2516	68	4896	2448
69	134,55	69	117,3	69	72,631	69	2553	69	4968	2484
70	136,5	70	119,	70	73,684	70	2590	70	5040	2520
71	138,45	71	120,7	71	74,737	71	2627	71	5112	2556
72	140,4	72	122,4	72	75,789	72	2664	72	5184	2592
73	142,35	73	124,1	73	76,842	73	2701	73	5256	2628
74	144,3	74	125,8	74	77,894	74	2738	74	5328	2664

BLACKBURN COUNT, 20 DENTS TO A BEER.

Multiply 45 by the number of dents in an inch, and divide by the number of dents in a beer, and the quotient will be the count of the reed.

45 inches.
33 dents in an inches.

135
135

Dents in a beer, 2,0)148,5

74,25 count of reed.

PRESTON 6-4ths COUNT, 20 DENTS TO A BEER.

Multiply 58 by the number of dents in an inch, and divide by 20, and the quotient will be the count of the reed.

58 inches.
33 dents in an inch.

174
174

Dents in a beer, 2,0)191,4

95,7 count of reed.

PRESTON 9-8ths COUNT, 20 DENTS TO A BEER.

44 inches.
33 dents in an inch.

132
132

Dents in a beer, 20)1452(72,6
140

52
40

120
120

N. B.—Some manufacturers in Oldham count same as Blackburn for fustians and velvets; printing cloths are same as Manchester.

PRESTON 4-4ths, OR YARD WIDE COUNT, 20 DENTS TO A BEER.

Multiply 39 by the number of dents in an inch, and divide by the number of dents in a beer, and the quotient will be the count of the reed.

39 inches.
33 dents in an inch.

117
117

Dents in a beer, 2,0)128,7

64,35 count of reed.

PRESTON 7-8ths COUNT, 20 DENTS TO A BEER.

Multiply 34 by the number of dents in an inch, and divide by the number of dents in a beer, and the quotient will be the count of the reed.

34 inches.
33 dents in an inch.

102
102

Dents in a beer, 2,0)112,2

56,1 count of reed.

NANKEEN COUNT, 19 DENTS TO A BEER.

Multiply 20 by the number of dents in an inch, and divide by the number of dents in a beer, and the quotient will be the count of the reed.

(See next page.)

20 inches.
33 dents in an inch.

Dents in a beer, 19)660(34,73, or nearly 34¾, count of reed.
57

90
76

140
133

70
57

13

SCOTCH AND CARLISLE COUNT.

Multiply 37 by the number of dents in an inch, and the product will be the count of the reed.

37 inches.
33 dents in an inch.

111
111

1221 count of reed.

SILK COUNT.

Multiply 36 by the number of dents in an inch, and that product by 2, which will be the count of the reed.

36 inches.
33 dents in an inch.

108
108

1188
2 ends in a dent.

2376 count of reed.

NUMBER OF DENTS IN A YARD.

Multiply the number of dents in an inch by the number of inches in a yard, and the product will be the number of dents in a yard.

33 dents in an inch.
36 inches in a yard.

198
99

1188 dents in a yard.

Some manufacturers count calicoes, checks, and handkerchiefs, by the number of beers in a yard, some 19, and some 20 dents to a beer.

By 20 dents to a beer.

36 inches 1 yard.
33 dents in an inch.

108
108

Dents in a beer, 2,0)118,8

59,4 count of reed.

By 19 dents to a beer.

36 inches 1 yard.
33 dents in an inch.

108
108

Dents in a beer, 19)1188(62,526 count of reed.
114

48
38

100
95

50
38

120
114

6

Some manufacturers of fustians, velvets, velveteens, velveretts, satteens, &c., count by the number of beers set on 24 inches at the reed, some 20, and some 19 dents to a beer.

24 inches.
33 dents in an inch.

72
72

Dents in a beer, 2,0)79,2

39,6 count of reed.

If there be 33 dents in an inch, how many beers, 19 dents to a beer, will there be in 24 inches?

33 dents in an inch.
24 inches.

132
66

Dents in a beer, 19)792(41,684 count of reed.
76

32
19

130
114

160
152

80
76

4

How many dents will there be in an inch, in a 6-4ths 145 Preston reed?

Multiply the count of the reed by the number of dents in a beer, and divide by the number of inches any given number of beers is set on, and the quotient will be the number of dents in an inch.

145 count of reed.
20 dents to a beer.

Inches set on, 58)2900(50, number of dents in an inch.
290

0

Whatever the count of the reed, or system of counting may be, by referring to the table, you will find the number of dents in an inch.

The number of dents in an inch multiplied by 2, and that product multiplied by the number of inches intended to be filled at the reed, will give the number of ends required in the warp, for any kind of plain goods.

MANUFACTURING.

Rules and examples for ascertaining the weight of warp and weft, required for the manufacture of any description of cotton goods, according to the length and width of the piece, and the fineness of yarns.

On account of some kind of goods requiring to be laid a greater length on the warping mill than others, it will be found the most accurate to ascertain the length and weight of twist required for the warp, and divide by the number of cuts or pieces in the warp, which will give the length and weight of twist (according to its fineness) required for one cut, or piece of cloth.

N. B.—The general allowance for waste, is about 1-50*th of the weight of weft required to weave the piece.*

TO ASCERTAIN THE WEIGHT OF A WARP.

RULE.—Multiply the length of the warp by the width in inches required at the reed, and that product by the number of ends in an inch, (which is the Manchester and Stockport count of reed,) for a dividend. Then multiply the number of yards in one hank by the number of hanks in the pound of twist for a divisor, and the quotient will be the weight of the warp.

N. B.—By referring to the reed table, the number of ends in an inch of any reed may be found, according to the system of counting.

Required, the weight of number 36's twist, for a warp 146 yards long, 29 inches wide at the reed, and 72 ends in an inch?

146 yards, length of warp.
29 inches, width at reed.

1314
292

4234
72 ends in an inch.

8468
29638

Dividend, 304848 yards of twist in the warp.

840 yards, 1 hank.
36 hanks in 1lb.

5040
2520

Divisor, 30240 yards in 1lb. of 36's twist.

30240)304848(10 lbs., 1¼ oz. weight of warp.
30240

2448
16 oz.=1 lb.

14688
2448

39168

(Continued.)

30240)39168(1 ounce.
30240

8928
4 qrs., 1 oz.

30240)35712(1 qr.
30240

5472

The weight of warp or weft may be found in a much easier way, by dividing the number of yards of twist, or weft required, by the number of yards in 1 ounce, which will be found in the yarn table according to the fineness of the yarns, as in the following example :—

Required, the weight of 36's twist, for a warp 146 yards long, 29 inches wide at the reed, and 72 ends in an inch?

146 yards, length of warp.
29 inches, width of warp at reed.

1314
292

4234
72 ends in an inch.

8468
29638

Dividend, 304848 yards in warp.

Yards in 1 oz. of 36's twist, 1890)304848(161¼ ounces, or 10 lbs.,
1890 1¼ oz., weight of warp.

11584
11340

2448
1890

558
4 qrs., 1 oz.

1890)2232(1 qr.
1890

342

If there be 304848 yards of 36's twist, in a warp containing 5 cuts, or pieces; what weight of twist will there be in 1 piece?

Cuts, or pieces in warp, 5)304848 yards of twist in warp.

Yards in 1 oz. of 36's twist, 1890)60969,6(32¼ oz., or 2 lbs., 0¼ oz., weight of twist required for 1 piece of cloth.

5670

4269
3780

489,6
4 qrs., 1 oz.

1890)1958,4(1 qr.
1890

68,4

Required, the weight of number 36's weft, to weave a piece of cloth 30 yards long, 29 inches wide, and 84 threads, or picks in an inch; allowing 1-40th for waste?

30 yards, length of piece.
29 inches, width of piece.

870
84 threads, or picks in an inch.

3480
6960

73080
Allowance for waste, 1-40 1827

Dividend, 74907 yards required to weave a piece.

(Continued.)

Yards in 1 ounce, 1890)74907(39½ oz., or 2 lbs., 7½ oz., weight of weft required to weave a piece of cloth.
5670
18207
17010
1197
4 qrs., 1 oz.
1890)4788(2 qrs.
3780
1008

Or thus,

1 lea is 12,0 yds.)7490,7 yards of weft required to weave a piece.

1 hank, 7 leas)624,225

Nos. of weft, 36's { 6)89,175 hanks, or 2 lbs., 7½ oz., weight of weft required.
6)14,8625

2,477083 lbs.
16 oz., 1 lb.
2862500
477083
7,633333 oz.
4 qrs., 1 oz.
2,533333 qrs.

Or thus,

840 yards, 1 hank.
36 hanks, 1 lb.
5040
2520

Divisor, 30240 yards in 1 lb. of 36's weft.

(Continued.)

Yards.
30240)74907(2 lbs. 7½ oz., weight of weft required.
60480

14427
16

86562
14427

30240)230832(7½
211680

19152

Required, the weight of number 60's twist, for a warp 146 yards long, 39 inches wide, and 106 ends to an inch?

146 yards, length of warp.
39 inches, width at the reed.

1314
438

5694
106 ends in an inch.

34164
56940

1 lea, 120 yards.)60356,4 yards of twist in warp.

1 hank is 7 leas.)5029,7 leas of twist in warp.

Numbers of twist 60)718,52857 hanks of twist in warp.

11,9754761 lbs. of twist in warp.
16 ounces, 1 lb.

58528566
9754761

15,6076176 ounces.
4 qrs., 1 oz.

2,4304704 qrs.

The weight of twist required for the warp, is 11 lbs., 15½ oz.

If there be 603564 yards of number 60's twist in a warp; what will it weigh?

Yards in 1 ounce of 60's twist, 3150)603564(191½ ounces, or
3150 11 lbs., 15½ oz.,
weight of warp.
28856
28350
5064
3150
1914
4 qrs., 1 oz.
3150)7656(2 qrs.
6300
1356

If a warp, 146 yards long, 39 inches wide, and 106 ends in an inch, weigh 12 lbs.; what numbers of twist will it be?

146 yards, length of warp.
39 inches, width of warp at reed.
1314
438
5694
106 ends in an inch.
34164
56940

Weight of warp, 12 lbs.)603564 number of yards in a warp.

1 hank is 840 yards.)50297(59,87 nearly, number 60's twist.
4200
8297
7560
7370
6720
6500
5880
620

What length and weight of number 80's weft, will it require to weave a warp 146 yards long, 39 inches wide at the reed, and 120 threads, or picks in an inch, allowing 1-50th for waste?

146 yards, length of warp.
120 threads, or picks in an inch.

17520
39 inches, width at reed.

157680
52560

683280
Add 1-50th for waste. 13665,6

696945,6 yards required to weave the warp.

1 lea is 12,0 yds.)69694,5,6 yards of weft required to weave a piece.

1 hank is 7 leas.)5807,88 leas of do.

829,69714 hanks.
7 leas, 1 hank.

4,87998 leas.
120 yards, 1 lea.

105,59760 yards.

The length of weft required to weave the warp will be 829 hanks, 4 leas, and 105$\frac{3}{4}$ yards.

Numbers of weft, 8,0)82,9,69714 hanks of 80's weft.

10,371214 lbs.
16 ounces, 1 lb.

2227284
37!214

5,939424 oz.
4 qrs., 1 oz.

3,757696 qrs.

10 lbs. 5$\frac{3}{4}$ oz., nearly 10 lbs., 6 oz. weight of 80's weft, required to weave the warp.

What length and weight of number 60's twist, will it require for a piece of cloth, 29½ yards long, 39 inches wide, and 106 ends in an inch?

29,2 yards, length of piece.
39 inches, width at reed.

2628
876

1138,8
106 ends to an inch.

68328
113880

Dividend, 120712,8 yards of twist required for a piece.

840 yards, 1 hank.
60's twist.

Divisor, 50400 yards in 1 lb. of number 60's twist.

50400)120712,8(2 lbs., 6¼ oz., weight of twist required for one piece of cloth.
100800

19912,8
16 ounce, 1 lb.

1194768
199128

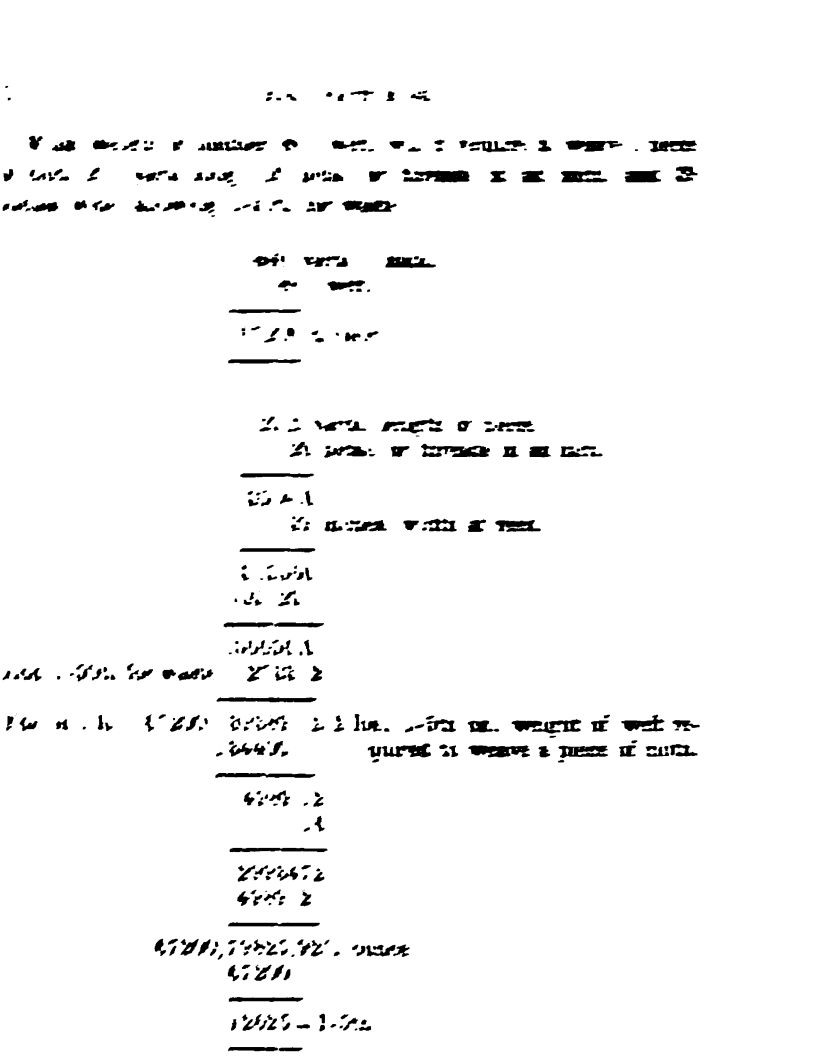
50400)318604,8(6 ounces.
302400

16204,8
4 qrs., 1 oz.

50400)64819,2(1 qr.
50400

14419

The weight of number 60's twist required for 1 piece of cloth, is 2 lbs., 6¼ oz., or 11 lbs., 15¼ ounces, for 1 warp containing 5 pieces.



What number of ends will it require in a warp, to fill 40½ inches in a 118 Manchester count?

118, count of Manchester reed.
40,5 inches, width at reed.

590
4720

4779,0 number of ends in warp.

What number of ends will it require to fill 50 inches in a 60 reed, Bolton count, 20 dents, or 40 ends to the beer?

60 reed, Bolton count.
40 ends, or 20 dents in 1 beer.

2400
50 inches, width at reed.

24¼ inches, or 24,25)120000,00(4948 ends required in the warp.
9700

23000
21825

11750
9700

20500
19400

1100

N. B.—It is not requisite to carry out the decimal fractions of an end.

For the different systems of counting reeds, see the reed table, with rules and examples.

What number of ends will be required in a warp, to fill 51 inches, in a 66 reed, Bolton count?

66 count of reed.
40 ends, or 20 dents to a beer.

2640
51 inches, width at reed.

2640
13200

134640 dividend. *(Carried to next page.)*

24½, or 24,25 inches.)134640(5552 ends required for warp.
12125

13390
12125

12650
12125

5250
4850

400

What number of ends will it require in a warp, to fill 30½ inches in a 74 reed, Blackburn count?

74, count of reed.
40 ends, or 20 dents to a beer.

2960
30,5 inches, width of warp at the reed.

14800
88800

Beers set on, 45 inches.)90280,0(2006 ends required for warp.
90

280
270

10

What width will 2006 ends fill, in a 74 reed, Blackburn count?

74, count of reed.
40 ends, or 20 dents to a beer.

2960 divisor.

Number of ends in warp, 2006
45 inches, number of beers set on.

10030
8024

90270 dividend.

90270 dvdd. by 2960 = 30,5, or 30½ in. nearly, width of warp at reed.

What number of ends will it require in a warp, to fill 49½ inches, in a 135 reed, Blackburn count?

135, count of reed.
40 ends, or 20 dents to a beer.

5400
49,5 inches, width of warp at the reed.

27000
48600
21600

45 inches, or { 9)267300,0 / 5)29700

5940 ends required in the warp.

What number of inches will 5940 ends fill, in a 135 reed, Blackburn count?

135, count of reed.
40 ends, or 20 dents to a beer.

5400 divisor.

5940 ends in the warp.
45 inches, number of beers set on reed.

29700
23760

5400)267300(49,5, or 49½ inches, width of warp at the reed.
21600

51300
48600

27000
27000

What number of ends must there be in a warp, to fill 48 inches in a Bolton 54 reed; allowing only 19 dents, or 38 ends to a beer?

54, count of reed.
38 ends, or 19 dents to a beer.

432
162

2052
48 inches, width of warp at the reed.

16416
8208

No. of brs set on, (inches. 24,25)98496,00(4062 ends required in the warp.
9700

14960
14550

4100
4850—nearly.

What number of inches will 4062 ends fill in a Bolton 54 reed; allowing 19 dents, or 38 ends to a beer?

54, count of reed.
38 ends, or 19 dents to a beer.

432
162

2052 divisor.

4062 ends in the warp.
24,25 inches, numbers of beer set on.

20310
8124
16248
8124

2052)98503,50(48 inches, width filled at the reed.
8208

16423
16416

7

What number of ends must there be in a warp, to fill 39½ inches, in a Bolton 44 reed; if there be 19 dents, or 38 ends to a beer?

44, count of reed.
38 ends, or 19 dents to a beer.

352
132

1672
39,5, or 39½ inches, width of warp at the reed.

8360
15048
5016

No. of beers set on, 24,25 in.)66044,00(2723 ends required for the warp.
4850

17544
16975

5690
4850

8400
7275

125

What number of inches will 2724 ends fill in a 44 reed, Bolton count; allowing 19 dents, or 38 ends to a beer?

44, count of reed.
38 ends, or 19 dents to a beer.

352
132

1672 divisor.

(Continued.)

2724 number of ends in the warp.
24,25, or 24½ inches, number of beers set on.

13620
5448
10896
5448

1672)66057,00(39,5, or 39½ inches, width filled at the reed.
5016

15897
15048

8490
8360

130

What number of ends must there be in a warp, to fill 51½ inches, in a 6-4ths 110 reed, Preston count?

110, count of reed, 6-4ths Preston.
40 ends, or 20 dents in a beer.

4400
51,5, or 51½ inches, width of warp at the reed.

22000
4400
22000

No. of beers set on, 58 in.)226600,0(3907, number of ends required for the warp.
174

526
522

400
406—nearly.

What number of inches will 3907 ends fill, in a 6-4ths 110 reed, Preston count?

110 count of reed, 6-4ths Preston.
40 ends, or 20 dents to a beer.

4400 divisor.

(Continued.)

3907, number of ends in the warp.
Number of beer set on, 58 inches.

31256
19535

4400)226606(51,5, or 51½ inches, width
22000 filled at the reed.

6606
4400

22060
22000

60

N. B.—The 6-4ths Preston count of reeds, is the number of beers set on 58 inches, 20 dents, or 40 ends to a beer.

The small difference which appears in the last two examples arises from the decimal of an end.

What number of ends must there be in a warp, to fill 51½ inches, in a 6-4ths 144 reed, Preston count ?

144, number of beers set on 58 inches at the reed.
40 ends, or 20 dents to a beer.

5760
51,5, or 51½ inches, width of warp at the reed.

28800
5760
28800

58 inches.)296640,0(5114, number of ends required for the warp.
290

66
58

84
58

260
232

28

What number of inches will 5114 ends fill, in a 6-4ths 144 reed, Preston count?

144, count of reed.
40 ends, or 20 dents to a beer.

5760 divisor.

5114, number of ends in the warp.

Number of beers set on 58 inches.

40912
25570

5760)296612(51,5, or 51½ inches, filled at the reed.
28800

8612
5760

28520
28800—nearly.

N. B.—The divisor is ascertained by multiplying the number of beers set on any given number of inches, (according to the adopted rule,) by the number of ends in a beer at the reed; and the dividend by multiplying the number of ends in the warp, by the number of inches any given number of beers is set on at the reed.

What number of ends must there be in a warp to fill 40½ inches, in a 9-8ths 125 reed, Preston count?

125, count of reed.
40 ends, or 20 dents to a beer.

5000
40,5, or 40½ inches, width of warp at the reed.

25000
200000

No. of beers set on, } inches.
44)202500,0(4602, number of ends required for the warp.
76

265
264

100
88

12

What number of inches will a warp containing 4602 ends fill, in a 9-8ths 125 reed, Preston count?

125 count of reed.
40 ends, or 20 dents in a beer.

5000 divisor.

4602 number of ends in the warp.
Number of beers set on 44 inches.

18408
18408

5,000)202,488

40,4976, or nearly 40½ inches, width the warp fills at reed.

N. B.—The 9-8ths Preston count of reeds is calculated according to the number of beers set on 44 inches, 20 dents to a beer.

When calculating the width at the reed any warp will fill according to the number of ends, the count of the reed must be multiplied by the number of ends filling 1 beer at the reed, for a divisor, whether 2, 3, 4, or more ends be in a dent, which will be according to the kind of goods made.

What number of ends must there be in a warp, to fill 39½ inches, in a 9-8ths 105 reed, Preston count?

105, count of reed.
40 ends, or 20 ends to a beer.

4200
39,5, or 39½ inches, width of warp at the reed.

21000
37800
12600

No. of beers set on 44 in.)165900,0(3770 number of ends required for the warp.
132

339
308

310
308

20

What number of inches will a warp containing 3770 ends fill, in a 9-8ths 105 reed, Preston count?

105, count of reed.
40 ends, or 20 dents to a beer.

4200 divisor

3770 number of ends in the warp.
No. of beers set on 44 inches.

15080
15080

4200)165880(39,49, or 39½ inches, width filled at the reed.
12600

39880
37800

20800
16800

40000
37800

2200

N. B.—Some manufacturers in Preston count their 9-8*ths*, 4-4*ths, and* 7-8*ths reeds, in the same proportion to a* 6-4*ths, set on* 58 *inches.*

What number of ends must there be in a warp, to fill 37 inches in a 4-4th, or yard wide 115 reed, Preston count?

115, count of reed.
40 ends, or 20 dents to a beer.

4600
37 inches, width of warp at the reed.

32200
13800

170200

(Carried to next page.)

No. of beers set on, 39 in.)170200(4364 number of ends required for
156 the warp.

142
117

250
234

160
156

4

How many inches will a warp containing 4364 ends fill, in a 4-4ths, or yard wide 115 reed, Preston count?

115, count of reed.
40 ends, or 20 dents to a beer.

4600 divisor.

4364 number of ends in the warp.
Number of beers set on 39 inches.

39276
13092

4600)170196(36,999, or 37 inches, width the warp
13800 fills at reed.

32196
27600

45960
41400

45600
41400

42000
41400

600

N.B.—The 4-4ths, or yard wide Preston count of reed, is calculated according to the number of beers set on 39 inches, 20 dents to a beer.

What number of ends must there be in a warp, to fill 34½ inches, in a 4-4ths, or yard wide reed, Preston count?

96, count of reed.
40 ends, or 20 dents to a beer.

3840
34,5, or 34½ inches width of warp at the reed.

19200
15360
11520

No. of beers set on 39 in.)132480,0(3397, number of ends required for the warp.
117 378
351
154 ——
117 270
273—nearly.
378 ——

How many inches will a warp containing 3397 ends fill, in a 4-4ths or yard wide 96 reed, Preston count?

96, count of the reed.
40 ends, or 20 dents to a beer.

3840 divisor.

3397 number of ends in the warp.
No. of beers set on 39 inches.

30573
10191

3840)132483(34,5, or 34½ inches, warp fills at the reed.
11520

17283
15360

19230
19200

30

N. B.—The 9-8*ths set on* 43½ *inches; the* 4-4*ths, or yard wide, set on* 38⅝ *inches, and the* 7-8*ths set on* 33⅘ *inches, will be in proportion to the* 6-4*ths reed being set on* 58 *inches.*

What number of ends must there be in a warp, to fill 32½ inches, in a 7-8ths 66 reed, Preston count?

66, count of reed.
40 ends, or 20 dents to a beer.

2640
32,5, or 32½ inches, width of warp at the reed.

13200
5280
7920

No. of brs. set on 34 in.)85800,0(2523 number of ends required for the warp.
68

178
170

80
68

120
102

18

How many inches will a warp containing 2523 ends fill, in a 7-8ths 66 reed, Preston count?

66, count of reed.
40 ends, or 20 dents to a beer.

2640 divisor.

2523 number of ends in the warp.
Number of beers set on 34 inches.

10092
7569

85782

(See next page.)

2640)85782(32,49, or 32½ inches, warp fills at the reed.
7920

6582
5280

13020
10560

24600
23760

840

N. B—The 7-8ths Preston count of reeds is calculated by the number of beers set on 34 inches, 20 dents to a beer.

What number of ends must there be in a nankeen warp, to fill 31½ inches, in a 60 reed.?

60, count of reed.
38 ends, or 19 dents to a beer.

480
180

2280
31,5, or 31½ inches, width of warp at the reed.

11400
2280
6840

No. of brs. set on, 2,0 in.)7182,0,0

3591 number of ends required for the warp.

What number of ends must there be in a nankeen warp, to fill 21 inches, in a 48 reed?

48, count of reed.
38 ends, or 19 dents to a beer.

384
144

1824
21 inches, width of warp at the reed.

1824
3648

No. of beers set on 2,0 in.)3830,4

1915 number of ends required for the warp.

What number of inches will a nankeen warp containing 1915 ends fill, in a 48 reed?

48, count of reed.
38 ends in a beer.

384
144

1824 divisor.

1915, number of ends in the warp.
20 inches, number of beers set on.

1824)38300(21 inches, width warp fills at the reed.
3648

1820
1824—nearly.

N.B.—The nankeen count of reeds is calculated by the number of beers set on 20 *inches,* 19 *dents to a beer.*

How many ends must there be in a warp, to fill 51½ inches, in a 1850 reed, Scotch count?

1850, count of reed.
51,5, or 51½ inches, width of warp at the reed.

9250
1850
9250

95275,0
2 ends in a dent, or split.

No. of dents set on 37 in.,)190550(5150 number of ends required for the warp.
185

55
37

185
185

0

How many inches will a warp containing 5150 ends fill, in a 1850 reed, Scotch count?

1850, count of reed.
2, number of ends in a dent, or split.

3700 divisor.

5150, number of ends in the warp.
Number of dents set on 37 inches.

36050
15450

3700)190550(51,5, or 51½ inches, warp fills at the reed.
18500

5550
3700

18500
18500

N. B.—In Carlisle, Scotland, Ireland, and the United States of America, they calculate their reeds by the number of dents set on 37 *inches.*

In Carlisle and Scotland a dent is generally termed a split.

How many ends must there be in a warp, to fill 49½ inches, in a 2150 reed, Scotch count?

2150, count of reed.
2, number of ends in a dent, or split.

4300
49,5, or 49½ inches, width of warp at the reed.

21500
38700
17200

No. of dents set on 37 in.)212850,0(5752, number of ends required for the warp.
185

278
259

195
185

100

100
74

26

How many inches will a warp containing 5752 ends fill, in a 2150 reed, Scotch count?

2150, count of reed.
2, number of ends in a dent, or split.

4300 divisor.

5752, number of ends in the warp.
Number of dents set on 37 inches.

40264
17256

4300)212824(49,49, or 49½ inches, nearly, warp fills at the reed.
17200

40824
38700

21240
17200

40400
38700

1700

What number of ends must there be in a silk warp, to fill 19 inches, in a 3700 reed?

3700, count of reed.
19 inches, width of warp required at the reed.

33300
3700

No. of ends in 36 in.)70300(1952 number of ends required for the warp.
36

343
324

190
180

100
72

28

How many inches will a silk warp containing 1952 ends fill, in a 3700 reed?

1952 number of ends in the warp.
Number of ends in 36 inches.

11712
5856

Count of reed 3700)70272(18,99, or 19 inches, nearly, width the warp fills at the reed.
3700

33272
29600

36720
33300

34200
33300

900

N. B.—The silk manufacturers generally calculate their reeds by twice the number of dents, or the number of ends in 36 *inches at the reed.*

LINEN YARN TABLES.

SHEWING the weight of 1 lea, or cut, English hank and bundle, Irish and Scotch hank, spangle, or spindle, and bundle, from 1 to 300 leas, or cuts in the pound progressively.

The following are the different sizes of reels in use, with the different systems of making up yarns.

YORKSHIRE REEL.

3 yards, or 108 inches in circumference.
100 threads, 1 lea, 300 yards.
10 leas, 1 hank, 3,000 yards.
20 hanks, 1 bundle, 60,000 yards.
Sells per bundle.

DORSET REEL.

2¼ yards or 81 inches in circumference.
40 threads, 1 knot, 90 yards.
20 knots, 1 ran, 1,800 yards.
12 rans, 1 dozen, 21,600 yards.
Sells per dozen.

N. B.—This reel is not much in use, the Irish reel being generally adopted.

IRISH AND SCOTCH REELS.

2½ yards, or 90 inches in circumference.
120 threads, 1 cut, 300 yards.
12 cuts, 1 hank, 3,600 yards.
4 hanks, 1 spangle, 14,400 yards.
12½ spangles, or 50 hanks, 1 bundle, 180,000 yards.
Sells per spangle in bundles.

POINTS IN WHICH THE THREE REELS AGREE.

40 knots, or 2 rans, make 1 hank Irish and Scotch, 3,600 yards.
8 hanks Dorset, or 4 hanks Irish and Scotch, make 1 spangle or spindle, 14,400 yards.
1½ spangles, or spindles, make 1 dozen Dorset, 21,600 yards.
12½ spangles or spindles, or 50 hanks Irish and Scotch, or 3 English bundles of 60,000 yards each, make 1 Irish bundle, 180,000 yards.

EXPLANATION TO THE LINEN YARN TABLES.

The first column is the numbers of yarn, opposite to which is the weight according to the length weighed.

N. B.—The pounds and ounces are avoirdupoise weight, and the penny-weights and grains are troy weight.

oz.	dwts.	grains.		grains.	
14	11	16	or	7000	troy are equal to 1 lb. avoirdupoise.
	18	5½	or	437½	troy are equal to 1 oz. avoirdupoise.

5250 ao.

The following are the dividends according to the length weighed.

	Yards.	Dividends.
1 lea, or cut	300	7,000
1 English hank	3,000	70,000
1 Irish and Scotch hank	3,600	84,000
1 spangle or spindle	14,400	336,000
1 English bundle	60,000	1,400,000
1 Irish bundle	180,000	4,200,000
1 knot, Dorset	90	2,100
1 ran, do.	1,800	42,000
1 dozen, do.	21,600	504,000

N. B.—By dividing any of the above dividends, according to the length weighed, by the number of grains in the weight, it will give the numbers of yarns; or divide by the numbers of yarns, and it will give the number of grains weight, according to the length weighed.

LINEN YARN TABLE.

From Number 1, to 110 leas, or cuts in the pound.

Weight per lea or cut of 300 yards.				Weight per English hank of 3000 yards.				Weight per English bundle of 60000 yards.			
Nos.	oz	dwts	grains.	lbs.	oz	dwts	grains.	lbs.	oz	dwts	grains.
1	16	0	0,	10	0	0	0,	200	0	0	0,
2	8	0	0,	5	0	0	0,	100	0	0	0,
3	5	6	1,83	3	5	6	1,83	66	10	12	3,66
4	4	0	0,	2	8	0	0,	50	0	0	0,
5	3	3	15,5	2	0	0	0,	40	0	0	0,
6	2	12	3,66	1	10	12	3,66	33	5	6	1,83
7	2	5	5,	1	6	15	15,	28	9	2	14,5
8	2	0	0,	1	4	0	0,	25	0	0	0,
9	1	14	4,27	1	1	14	4,27	22	3	10	3,05
10	1	10	22,5	1	0	0	0,	20	0	0	0,
11	1	8	6,83		14	9	22,63	18	2	16	13,72
12	1	6	1,83		13	6	1,83	16	10	12	3,66
13	1	4	4,96		12	5	14,61	15	6	2	19,3
14	1	2	14,5		11	7	19,5	14	4	10	10,
15	1	1	5,16		10	12	3,6	13	5	6	1,83
16	1	0	0,		10	0	0,	12	8	0	0,
17		17	3,76		9	7	12,14	11	12	4	6,94
18		16	4,88		8	16	4,88	11	1	14	4,27
19		15	8,41		8	7	16,21	10	8	7	16,21
20		14	14,		8	0	0,	10	0	0	0,
25		11	16,		6	7	7,	8	0	0	0,
30		9	17,33		5	6	1,83	6	10	12	3,66
35		8	8,		4	10	10,	5	11	7	19,5
40		7	7,		4	0	0,	5	0	0	0,
45		6	11,55		3	10	3,05	4	7	2	0,61
50		5	20,		3	3	15,5	4	0	0	0,
55		5	7,25		2	16	13,72	3	10	3	7,54
60		4	20,66		2	12	3,66	3	5	6	1,83
65		4	11,69		2	8	9,92	3	1	4	4,96
70		4	4,		2	5	5,	2	13	13	0,5
75		3	21,33		2	2	10,33	2	10	12	3,66
80		3	15,5		2	0	0,	2	8	0	0,
85		3	10,35		1	16	2,02	2	5	11	19,08
90		3	5,77		1	14	4,27	2	3	10	3,05
95		3	1,68		1	12	11,3	2	1	12	11,34
100		2	22,		1	10	22,5	2	0	0	0,
105		2	18,66		1	9	13,1	1	14	8	6,33
110		2	15,63		1	8	6,8	1	13	1	15,77

Required, the weight of 1 lea of number 18's yarn?

Dividend.

Numbers of yarn, 18)7000(388,8 grains, or 16 dwts., $4\frac{8}{9}$ grains, weight required.

54

160
144

160
144

160
144

16

Required, the weight of 1 English hank of number 18's yarn?

Dividend.

Numbers of yarn, 18)70000(3888,88 grains, or 8 oz., 16 dwts., $4\frac{8}{9}$ grains, weight required.

54

160
144

160
144

160
144

160

160
144

160
144

16

How many ounces, pennyweights, and grains, are there in 3888,88 grains?

Grains. Grains.

1 oz. is equal to 437,5)3888,88(8 ounces.

35000

1 pennyweight is 24 grs.)388,88(16 dwts.

24

148
144

4,88 grains.

8 oz., 16 dwts.. 4,88 grains, weight required.

LINEN YARN TABLE.

From Number 1 to 110 leas, or cuts in 1 pound.

Weight per Irish and Scotch hank of 3600 yards.					Weight per spangle or spindle of 14,400 yards				Wgt. per Irish bundle of 180,000 yards			
Nos.	lbs.	oz	dwts	grains.	lbs.	oz	dwts	grains.	lbs.	oz	dwts	grns.
1	12	0	0	0,	48	0	0	0,	600	0	0	0,
2	6	0	0	0,	24	0	0	0,	300	0	0	0,
3	4	0	0	0,	16	0	0	0,	200	0	0	0,
4	3	0	0	0,	12	0	0	0,	150	0	0	0,
5	2	6	7	7,	9	9	10	22,5	120	0	0	0,
6	2	0	0	0,	8	8	0	0,	100	0	0	0,
7	1	11	7	19,5	6	13	13	0,5	85	11	7	19,5
8	1	8	0	0,	6	0	0	0,	75	0	0	0,
9	1	5	6	1,83	5	5	6	1,83	66	10	12	3,6
10	1	3	3	15,5	4	12	14	14,	60	0	0	0,
11	1	1	8	6,86	4	5	14	21,95	54	8	13	6,1
12	1	0	0	0,	4	0	0	0,	50	0	0	0,
13		14	14	0,53	3	11	1	9,65	46	2	8	9,9
14		13	13	0,5	3	6	15	15,	42	13	13	0,5
15		12	14	14,	3	3	3	15,5	40	0	0	0,
16		12	0	0,	3	0	0	0,	37	8	0	0,
17		11	5	8,67	2	13	3	5,2	35	4	12	20,8
18		10	12	3,66	2	10	12	3,66	33	5	6	1,8
19		10	1	22,05	2	8	7	16,21	31	9	4	19,1
20		9	10	22,5	2	6	7	7,	30	0	0	0,
25		7	12	9,5	1	14	13	3,	24	0	0	0,
30		6	7	7,	1	9	10	22,5	20	0	0	0,
35		5	8	20,5	1	5	17	4,5	17	2	5	5,
40		4	14	14,	1	3	3	15,5	15	0	0	0,
45		4	4	20,66	1	1	1	5,16	13	5	6	1,8
50		3	15	7,5		15	6	13,5	12	0	0	0,
55		3	8	22,77		13	17	13,59	10	14	9	22,6
60		3	3	15,5		12	14	14,	10	0	0	0,
65		2	17	9,3		11	14	20,73	9	3	12	14,8
70		2	13	13,		10	17	17,	8	9	2	14,5
75		2	10	5,		10	4	9,	8	0	0	0,
80		2	7	7,		9	10	22,5	7	8	0	0,
85		2	4	17,23		9	0	15,44	7	0	17	3,7
90		2	2	10,33		8	9	17,33	6	10	12	3,6
95		2	0	9,21		8	1	12,84	6	5	0	23,0
100		1	16	18,5		7	12	9,5	6	0	0	0,
105		1	15	2,5		7	5	17,5	5	11	7	19,5
110		1	13	14,13		6	17	21,54		7	4	23,3

Required, the weight of 1 spangle of number 19's yarn ?

dividend.

Numbers of yarn, 19)33600(17684,2 grains. weight required.

19

146
133

130
114

160
152

80
76

40
38

2

How many pounds, ounces, and pennyweights are there in 17684,2 grains?

Grains. Grains.

1 lb. is equal to 7000)17684,2(2 lbs., 8 oz., 7 dwts., 16½ grains.

14000

1 oz. is equal to 437,5 grs.)3684,2(8 oz.

35000

1 dwt. is equal to 24 grs.)184,2(7 dwts.

168

16½ grains.

Required, the weight of 1 English bundle of number 34's yarn ?

Dividend.

Numbers of yarn, 34)1400000(41176 grains, or 5 lbs., 14 oz., 2 dwts., 3½ grains.

136

40
34

60
34

260

260
238

220
204

16

LINEN YARN TABLE.

From Number 115 to 300 leas in 1 pound.

Weight per lea, or cut of 300 yards.			Weight per English hank of 3000 yards.			Weight per English bundle of 60,000 yards.			
Nos.	dwts.	grains.	oz	dwts.	grains.	lbs.	oz	dwts.	grains.
115	2	12,86	1	7	3,1	1	11	15	1,41
120	2	10,33	1	6	1,8	1	10	12	3,66
125	2	8,	1	5	2,5	1	9	10	22,5
130	2	5,84	1	4	4,96	1	8	11	5,23
135	2	3,85	1	3	9,03	1	7	12	19,87
140	2	2,	1	2	14,5	1	6	15	14,
145	2	0,27	1	1	21,25	1	6	1	6,17
150	1	22,66	1	1	5,18	1	5	6	1,83
155	1	21,16	1	0	14,11	1	4	11	18,25
160	1	19,75	1	0	0,	1	4	0	0,
165	1	18,42		17	16,24	1	3	7	4,34
170	1	17,17		17	3,74	1	2	15	0,29
175	1	16,		16	16,	1	2	5	5,
180	1	14,88		16	4,88	1	1	14	4,27
185	1	13,83		15	18,37	1	1	5	10,06
190	1	12,84		15	8,42	1	0	15	8,42
195	1	11,89		14	22,97	1	0	7	11,48
200	1	11,		14	14,	1	0	0	0,
205	1	10,14		14	5,46		15	11	2,76
210	1	9,33		13	21,33		15	4	8,16
215	1	8,55		13	13,58		14	16	2,62
220	1	7,81		13	6,18		14	9	22,63
225	1	7,11		12	23,11		14	4	1,22
230	1	6,43		12	16,34		13	16	15,45
235	1	5,78		12	9,87		13	11	5,95
240	1	5,16		12	3,66		13	6	1,83
245	1	4,571		11	21,71		13	1	2,785
250	1	4,		11	16,		12	14	14,
255	1	3,45		11	10,5		12	10	0,196
260	1	2,923		11	5,23		12	5	14,615
265	1	2,414		11	0,14		12	1	9,018
270	1	1,925		10	19,25		11	15	12,685
275	1	1,454		10	14,54		11	11	14,
280	1	1,		10	10,		11	7	19,
285	1	0,561		10	5,67		11	4	3,
290	1	0,137		10	1,37		11	0	15,
295		23,728		9	21,28		10	15	10,
300		23,333		9	17,33		10	12	3,

Required, the weight of 1 Irish bundle of 66's yarn ?

Numbers of yarn, 66)4200000(63636,36 grains.

396	
240	420
198	396
420	240
396	198
240	420
198	396
420	24

Grains. Grains.

1 lb. is equal to 7000)63636,36(9 lbs., 1 oz., 8 dwts., 6,86 grains, weight required.
63000

1 oz. is equal to 437,5 grs.)636,36(1 oz.
4375

1 dwt. is equal to 24 grns.)198,86(8 dwts.
192

6,86 grains.

lbs. *Or,*

Numbers of yarn, 66)600(9 lbs., 1 oz., 8 dwts., 6,86 grains, weight required.
594

6
16 oz., 1 lb.

Numbers of yarn, 66)96(1 oz.
66

30
437,5 grains, 1 oz.

Nos. of yarn, 66)13125,0(198,86 grains, or 8 dwts., 6,86 grains.

66	585
652	528
594	570
585	528
	42

LINEN YARN TABLE.

From Number 115 to 300 leas, or cuts in 1 pound.

Weight per Irish and Scotch hank of 3600 yards.				Wgt. per spangle or spin. of 14,400 yds.			Weight per Irish bundle of 180,000 yards.			
Nos.	oz	dwts.	grains.	oz	dwts.	grains.	lbs.	oz	dwts	grains.
115	1	12	4,93	6	12	8,74	5	3	8	17,23
120	1	10	22,5	6	7	7,	5	0	0	0,
125	1	9	18,5	6	2	15,	4	12	14	14,
130	1	8	16,65	5	16	13,11	4	9	15	10,19
135	1	7	16,72	5	12	13,38	4	7	2	0,61
140	1	6	18,5	5	8	20,5	4	4	10	10,
145	1	5	21,81	5	5	9,74	4	2	3	18,51
150	1	5	2,5	5	2	4,5	4	0	0	0,
155	1	4	8,43	4	17	9,74	3	13	17	1,37
160	1	3	15,5	4	14	14,	3	12	0	0,
165	1	2	23,59	4	11	22,36	3	10	3	7,54
170	1	2	8,61	4	9	10,47	3	8	8	13,87
175	1	1	18,5	4	7	2,	3	6	15	15,
180	1	1	5,16	4	4	20,66	3	5	6	1,83
185		0	16,55	4	2	18,21	3	3	16	6,2
190		0	4,6	4	0	18,42	3	2	9	14,26
195		17	22,76	3	17	2,57	3	1	4	1,96
200		17	12,	3	15	7,5	3	0	0	0,
205		17	1,756	3	13	14,52	2	14	15	2,8
210		16	16,	3	11	23,5	2	13	13	0,5
215		16	6,69	3	10	10,29	2	12	11	20,88
220		15	21,81	3	8	22,77	2	11	11	14,41
225		15	13,33	3	7	12,84	2	10	12	3,66
230		15	5,21	3	6	4,37	2	9	13	11,36
235		14	21,44	3	4	21,28	2	8	15	12,34
240		14	14,	3	3	15,5	2	8	0	0,
245		14	6,857	3	2	10,928	2	7	3	8,357
250		14	0,	3	1	7,5	2	6	7	7,
255		13	17,411	3	0	5,147	2	5	11	19,088
260		13	11,076	2	17	9,307	2	4	16	19,846
265		13	4,981	2	16	8,924	2	4	4	3,054
270		12	23,111	2	15	9,444	2	3	10	3,055
275		12	17,45	2	14	10,81	2	2	16	17,72
280		12	12,	2	13	13,	2	2	5	5,
285		12	6,73	2	12	15,94	2	1	12	11,34
290		12	1,65	2	11	19,62	2	1	1	21,25
295		11	20,74	2	10	23,98	2	0	9	21,28
300		11	16,	2	10	5,	2	0	0	0,

Required, the weight of an Irish or Scotch hank of number 68's yarn?

Dividend.

Numbers of yarn, 68)84000(1235,29 grains.

68

160
136

240
204

360
340

200

200
186

640
612

28

Grains. Grains.

1 oz. is equal to 437,5)1235,29(2 oz., 15 dwts., 0,29 grains, weight required.

8750

1 dwt. is equal to 24 grns.)360,29(15 dwts.

24

120
120

0,29 grain.

How many yards are there in 1 lb. and in 1 oz. of number 68's yarn?

300 yards is 1 lea, or cut.

Numbers of yarn, 68

20400 number of yards in 1 lb.

1 lb. is equal to 16 oz.)20400(1275 yards in 1 oz.

16

44
32

120
112

80
80

Required, the weight of 1 spangle of number 85's yarn?

Dividend.

Numbers of yarn, 85)336000(3952,94 grains.

255

810
765

450
425

250
170

800

800
765

355
340

15

Grains. Grains.

1 oz. is equal to 437,5)3952,94(9 oz, 0 dwts., 15,44 grains, weight required.

39375

15,44

If 1 spangle of linen yarn weighs 9 oz., 15½ grains; what numbers will it be?

9 oz., 15,5 grains.

437,5 grains are equal to 1 oz.

3953,0 grains.

Grains. Dividend.

9 oz., 15½ grains are equal to 3953)336000(85 leas, or cuts in 1 lb., which is the nos. of yarn.

31624

19760
19765—nearly.

How many yards of number 85's yarn, are there in 1 lb. and in 1 oz?

300 yards, 1 lea, or cut.

85, numbers of yarn.

16 oz., 1 lb. { 4)25500 yards in 1 lb.

4)6375

1593,75, or 1593¾ yards in 1 oz.

Required, the weight of an Irish, or Scotch hank of number 95's yarn?

Dividend.
Numbers of yarn, 95)84000(884,21 grains, weight required.
760
800
760
400
380
200
190
100
95
5

Grains. Grains.
1 oz. is equal to 437,5)884,21(2 oz., 0 dwts., 9,21 grains, weight required.
8750
9,21 grains.

If 1 Irish or Scotch hank of linen yarn weighs 2 oz., 0 dwts., 9¼ grains; what numbers will it be?

437,5 grains are equal to 1 oz.
2
875,0 grains are equal to 2 oz.
Add 9,25 grains.
884,25 grains is equal to 2 oz., 0 dwts., 9¼ grains.

Grains. Dividend.
884,25)84000,00(94,99, or nearly 95 numbers of yarn.
795825
441750
353700
880500
795825
846750
795825
40925

Required, the weight of 1 Irish bundle of numbers 107's yarn?

Dividend.

Numbers of yarn, 107)4200000(39252,33 grains, weight required.

321

990
963

270
214

560
535

250
214

360
321

390

390
321

69

Grains. Grains.

1 lb. is equal to 7000)39252,33(5 lbs., 9 oz., 13 dwts., 2,83 grains, weight required.

35000

1 oz. is equal to 437,5 grns.)4252,33(9 oz.

39375

1 dwt. is equal to 24 grains.)314,83(13 dwts.

24

74
72

2,83 grains.

If 1 Irish bundle of linen yarn weighs 5 lbs., 9 oz., 13 dwts., 2,83 grains, or 39252,33 grains; what numbers will it be?

Grains.

39252,33)4200000,00(107, numbers of yarn.

3925233

27476700
27476631

69

Required, the weight of 1 English bundle of numbers 138 yarn?

Dividend.

Numbers of yarn, 138)1400000(10144,927 grains, weight required.

138

200
138

620
552

680
552

1280
1242

380
276

1040
966

74

Grains. Grains.

1 lb. is equal to 7000)10144,927(1 lb., 7 oz., 3 dwts., 10,427 grains, weight required.

7000

1 oz. is equal to 437,5 grns.)3144,927(7 oz.

30625

1 dwt. is equal to 24 grains.)82,427(3 dwts.

72

10,427 grains.

If 1 English bundle of linen yarn weighs 1 lb., 7 oz., 3 dwts., $10\frac{1}{2}$ grains; what numbers will it be?

Grains. Dividend.

1 lb., 7 oz., 3 dwts., $10\frac{1}{2}$ grains,=10145)1400000(138, numbers of yarn, nearly.

10145

38550
30435

81150
81160—nearly.

Required, the weight of 1 English hank of number 138's yarn?

Dividend.

Numbers of yarn, 138)70000(507,246 grains, weight required.
690

1000
966

340
276

640
552

880
828

52

Grains. Grains.

1 oz. is equal to 437,5)507,246(1 oz., 2 dwts., 21¼ grains nearly,
4375 weight required.

1 dwt. is equal to 24 grs.)69,746(2 dwts.
48

21,746 grains.

Required, the weight of 1 English bundle of number 128's yarn?

Dividend.

Numbers of yarn, 128)1400000(10937,5 grains, weight required.
128

1200
1152

480
384

960

960
896

640
640

Grains. Grains.

1 lb. is equal to 7000)10937,5(1 lb., 9 oz., weight required.
7000

1 oz. is equal to 437,5 grns.)3937,5(9 oz.
39375

Required, the weight of 1 lea, or cut of 154's yarn?

Dividend.

Numbers of yarn, 154)7000(45,45 grains, or nearly 1 dwt., 21½ grains, weight required.

616

840
770

700
616

840
770

70

Required, the weight of 1 English hank of number 154's yarn?

Numbers of yarn, 154)700000(454,54 grains, weight required.

616

840
770

700
616

840

840
770

700
616

84

How many ounces, pennyweights, and grains, are there in 454,54 grains?

1 oz. is equal to 437,5 grns.)454,545454(1,03896 ounces.

4375

17045
13125

39204
35000

42045
39375

26704
26250

454

437,5 grains = 1 oz.

19480
27272
11688
15584

17,045000 grains, or 1 oz. 0 dwts., 17 grains, weight required.

Required, the weight of 1 English bundle of number 165's yarn?

Dividend.

Numbers of yarn, 165)1400000(8484,848 grains, weight required.

1320

800
660

1400
1320

800
660

1400
1320

800
660

1400
1320

80

800

How many pounds, ounces, pennyweights, and grains are there in 8484,848 grains?

Grains. Grains.

1 lb. = 7000)8484,848(1 lb., 3 oz., 7 dwts., 4,348 grains.

7000

1 oz. = 437,5 grains.)1484,848(3 oz.

13125

1 dwt. = 24 grains.)172,348(7 dwts.

168

4,348 grains.

If 1 English bundle of yarn weighs 1 lb., 3 oz., 7 dwts., 4,348 grains, or 1484,848 grains; what numbers will it be?

Dividend.

1 bundle weighs 8484,848 grns.)1400000,000(165's numbers of yrn.

8484848

55151520
50909088

42424320
42424240

How many yards are there in 1 pound of 184's yarn?

184, numbers of yarn.
300 yards are 1 lea of number 1.

55200, number of yards in 1 lb.

Required, the weight of 1 Irish, or Scotch hank of number 184's yarn?

Dividend.
Numbers of yarn, 184)84000(456,52 grains, weight required.

736	
1040	960
920	920
1200	400
1104	368
960	32

Grains. Grains.
1 oz.=437,5)456,52(1 oz., 0 dwts., 19,02 grains, weight required.
437,5

19,02 grains.

Required, the weight of 1 English hank of number 180's yarn?

Dividend.
Numbers of yarn, 180)70000(388$\frac{4}{9}$ grains, weight required.

540	
1600	
1440	
1600	
1440	
160	

1 dwt. is equal to 24 grns.)388$\frac{4}{9}$(16 dwts., 4$\frac{4}{9}$ grains, weight required.
24

148
144

4 8-9ths.

Required, the weight of 1 Irish spangle, or Scotch spindle of number 196's?

Dividend.

Numbers of yarn, 196)336000(1714,285 grains, weight required.

196

1400
1372

280
196

840
784

560
392

1680

1680
1568

1120
980

140

Grains. Grains.

1 oz.=437,5)1714,285(3 oz., 16 dwts., 17,785 grains, weight required.

13125

1 dwt.=24 grains.)401,785(16 dwts.

24

161
144

17,785 grains.

How many yards are there in 1 oz. of number 196's?

196, numbers, or counts of yarn.

300 yards are 1 lea of number 1's.

1 lb.=16 oz.)58800(3675 yards of nos. 196's in 1 oz.

48

108
96

120
112

80
80

Required, the weight of 1 lea, or cut of number 215's weft?

Dividend.

Numbers of yarn, 215)7000(32,558 grains, or 1 dwt., 8½ grains, weight required.

645

550
430

1200
1075

1250
1075

1750
1720

30

Required, the weight of 1 Irish, or Scotch hank of number 235's yarn?

Dividend.

Numbers of yarn, 235)84000(357,446 grains, weight required.

705

1350
1175

1750
1645

1050
940

1100

1100
940

1600
1410

190

1 dwt.=24 grains, or { 4)357,446 grains.
6)89,3615

14,89358, or 14 dwts., 21½ grains, nearly.

How many yards are there in 1 pound of number 235's yarns.

235. numbers of yarn.
300 yards 1 lea, or cut of number 1's.

70500 number of yards required.

Required, the weight of 1 Irish bundle of number 130's yarn?

Dividend.

Numbers of yarn, 130)4200000(32307,692 grains, weight required.

390

300
260

400
390

1000
910

900
780

1200
1170

300

300
260

40

Grains. Grains.

1 lb.=7000)32307,692(4 lbs., 9 oz., 15 dwts., $10\frac{1}{2}$ grains
28000 nearly, weight required,

1 oz.=437,5 grns.)4307,692(9 oz.
3937,5

1 dwt.,=24 grains.)370,192(15 dwts.
24

130
120

10,192 grains.

If 1 Irish bundle of yarn weighs 4 lbs., 9 oz., 15 dwts., 10,192 grains, or 32307,692 grains; what numbers will it be?

Dividend.

Weight, 32307,692)4200000,00(130, numbers of yarn.
32307692

96923080
96923076

40

Required, the weight of 1 English hank of numbers 245 yarn?

Dividend.

Numbers of yarn, 245)70000(285,714 grains, weight required.

490	
2100	
1960	
1400	350
1225	245
1750	1050
1715	980
350	70

Grains. Grains.

1 dwt.=24)285,714(11 dwts., 21¾ grains nearly, weight required.

24
45
24
21,714

Required, the weight of 1 Irish, or Scotch hank of number 240's yarn?

Dividend.

Numbers of yarn, 240)84000(350 grains, weight required.

720
1200
1200

1 dwt.=24 grns.) { 2)350 grains. / 12)175

14 dwts., 14 grains, weight required.

How many yards are there in 1 Irish, or Scotch hank of yarn?

300 yards, 1 lea, or cut.

12 leas, or cuts, are 1 Irish, or Scotch hank.

3600 yards in 1 Irish, or Scotch hank.

Required, the weight of 1 Irish spangle, or Scotch spindle of number 265's yarn?

Dividend.
Numbers of yarn, 265)33600(1267,92 grains, weight required.
265
710
530
1800
1590
2100
1855
2450
2385
650
530
120

Grains. Grains.
1 oz.=437,5)1267,92(2 oz., 16 dwts., 9 grains nearly, weight required.
875,0

1 dwt.=24 grains.)392,92(16 dwts.
24
152
144
8,92 grains.

How many yards are there in 1 oz. of number 265's yarn?

265 numbers of yarn.
300 yards, 1 lea or cut.

1 lb.=16 oz. { 4)79500
4)19875

4968,75, or 4968¾ yards in 1 oz.

Required, the weight of 1 lea, or cut of number 298's yarn?

Dividend.

Numbers of yarn, 298)7000(23,49, or 23½ grains nearly, weight required.

596

1040
894

1460
1192

2680
2682—nearly.

Required, the weight of 1 English bundle of number 295's yarn?

Dividend.

Numbers of yarn, 295)70000(237,288 grains, weight required.

590

1100
885

2150
2065

850
590

2600
2360

2400
2360

40

1 dwt. = 24 grains.)237,288(9 dwts., 21¼ grains, weight required.

216

21,288 grains.

How many yards are there in 1 lb. of number 295's yarn?

295, numbers of yarn.
300 yards in 1 lea, or cut.

88500 yards in 1 lb. of number 295's yarn.

In calculating the weight of linen yarns required to produce any fabric of cloth, the rules are the same as those in cotton, with this exception only, 300 yards constitute the lea, or cut in linen, which counts in the numbers of yarn, the same as 840 yards in cotton.

What will the weight of a linen warp be, 124 yards long, containing 2160 ends made from 80's yarn?

2160, ends in the warp.
124

8640
4320
2160

1 lea = 3,00 yards.)2678,40

Numbers of yarn, 8,0)89,2,8

11,16 lbs.
16 oz. are 1 lb.

96
16

2,56 oz.
4 qrs., 1 oz.

2,24 quarters.

The weight of the warp will be 11 lbs., 2 oz., 2,24 qrs.

If a warp be 34 inches wide at the reed, containing 2160 ends; how many ends will there be in the inch?

34)2160(63,53, or 63½ ends in an inch at the reed.
204

120
102

180
170

100
102—nearly.

What weight of number 95's linen yarn will it require to weave a warp 124 yards long, 34 inches wide, and 76 picks, or threads in an inch?

124 yards, length of warp.
34 inches, width of warp at the reed.

496
372

4216
76 picks, or threads in an inch.

25296
29512

1 lea is equal to 3,00yds.)3204,16

Numbers of yarn, 95)1068,0533(11,2426 lbs.
95

118
95

230
190

405
380

253
190

633
570

63

16 oz. are 1 lb.

14556
2426

3,8816
4 qrs. are 1 oz.

3,5264, or 11 lbs., 3 oz., 3½ qrs. neat weight required to weave the above.

N. B.—Allowance must be made for waste.

The length and weight of linen yarns required for manufacturing any fabric of linen cloth, may be ascertained in the same manner as illustrated in the two preceding examples.

WORSTED AND WOOLLEN YARNS.

ALL worsted and woollen yarns being sold by the gross, it is necessary that the manufacturer of worsted and woollen pieces be well acquainted with the weight per gross according to the fineness of the yarns, in order to insure the proper weight of the piece he is making. The yarn being too heavy, even if made from wool of a proper quality, gives an inferior appearance.

It is particularly necessary for the spinner to keep a strict check upon the working of his machinery; wool being much sooner affected by the atmosphere than cotton.

The usual plan of trying the fineness of worsted, or woollen yarns is, to weigh 1 hank, and if the result be doubtful, to take a quarter of a gross from each frame, or collectively, as circumstances may require.

The following tables will shew the weight of 1 hank, 1 dozen, and 1 gross of worsted, or woollen yarns, from number 1 to 270 hanks in the pound.

If the weight of a less quantity than 1 hank should be required, rules and examples will be found after the next table.

EXPLANATION TO THE FOLLOWING TABLES.

The first and last columns contain the numbers or counts of yarn; opposite to which in the table is the weight according to the length weighed.

560 yards make 1 hank.
12 hanks make 1 dozen.
12 dozens, or 144 hanks make 1 gross.

N. B.—The pounds and ounces are avoirdupoise weight, the pennyweights and grains are troy weight.

24 grains are equal to 1 pennyweight.
18 pennyweights, 5½ grains troy are equal to 1 ounce avoirdupoise.
16 ounces are equal to 1 lb.

Or,

24 grains make 1 pennyweight.
437½ grains make 1 ounce avoirdupoise.
7000 grains make 1 pound avoirdupoise.

WORSTED AND WOOLLEN YARN TABLE.

From Number 1 to 40 hanks in the pound.

	Wght. of 1 hank			Weight of 1 dozen.				Weight of 1 gross.				
Nos.	oz	dwts	grains.	lbs.	oz	dwts	grns.	lbs.	oz	dwts	grains.	No.
1	16	0	0,	12	0	0	0,	44	0	0	0,	1
2	8	0	0,	6	0	0	0,	72	0	0	0,	2
3	5	6	1,8	4	0	0	0,	48	0	0	0,	3
4	4	0	0,	3	0	0	0,	36	0	0	0,	4
5	3	3	15,5	2	6	7	7,	28	12	14	14,	5
6	2	12	3,6	2	0	0	0,	24	0	0	0,	6
7	2	5	5,	1	11	7	19,5	20	9	2	14,5	7
8	2	0	0,	1	8	0	0,	18	0	0	0,	8
9	1	14	4,2	1	5	6	1,8	16	0	0	0,	9
10	1	10	22,5	1	3	3	15,5	14	6	7	7,	10
11	1	8	6,8	1	1	8	6,8	13	1	8	6,	11
12	1	6	1,8	1	0	0	0,	12	0	0	0,	12
13	1	4	4,9		14	14	0,5	11	1	4	4,9	13
14	1	2	14,5		13	13	0,5	10	4	10	10,	14
15	1	1	5,1		12	14	14,	9	9	10	22,5	15
16	1	0	0,		12	0	0,	9	0	0	0,	16
17		17	3,7		11	5	8,6	8	7	9	15,6	17
18		16	4,8		10	12	3,6	8	0	0	0,	18
19		15	8,4		10	1	22,	7	9	4	19,1	19
20		14	14,		9	10	22,5	7	3	3	15,5	20
21		13	21,3		9	2	14,5	6	13	13	0.5	21
22		13	6,1		8	13	6,1	6	8	13	5.75	22
23		12	16,3		8	6	8,1	6	4	3	4,	23
24		12	3,6		8	0	0,	6	0	0	0,	24
25		11	16,		7	12	9,5	5	12	2	22,	25
26		11	5,2		7	7	0,2	5	8	11	5,2	26
27		10	19,2		7	2	0,6	5	5	6	1,8	27
28		10	10,		6	15	15,	5	2	5	5,	28
29		10	1,3		6	11	7,5	4	15	8	4,1	29
30		9	17,3		6	7	7,	4	12	14	14,	30
31		9	9,8		6	3	12,6	4	10	5	21,1	31
32		9	2,7		6	0	0,	4	8	0	0,	32
33		8	20,1		5	14	21,9	4	5	14	21,6	33
34		8	13,8		5	11	19,	4	3	13	22,5	34
35		8	7,9		5	8	20,5	4	1	15	2,5	35
36		8	2,4		5	6	1,8	4	0	0	0,	36
37		7	21,1		5	3	10,7	3	14	4	22,2	37
38		7	16,2		5	0	23,	3	12	11	12,3	38
39		7	11,4		4	16	19,8	3	11	1	14,45	39
40		7	7,		4	14	14,	3	9	10	22,5	40

If the weight of any shorter length than stated in the preceding table should be required, it may be ascertained by taking the number opposite the length weighed as shewn below for a dividend, and the numbers, or counts of yarn for a divisor, and the quotient will be the weight in grains; or, take the number of grains any given length weighs for a divisor, and the number opposite that given length for a dividend, and the quotient will be the numbers, or counts of yarn roving, &c.

	Given lengths. Yards.	Dividends.
1 gross, or	80640	1008000
1 dozen, or	6720	84000
1 hank, or	560	7000
6 leas, or	480	6000
5 leas, or	400	5000
4 leas, or	320	4000
3 leas, or	240	3000
2 leas, or	160	2000
1 lea, or	80	1000
¾ lea, or	60	750
½ lea, or	40	500
¼ lea, or	20	250
⅛ lea, or	10	125
$\frac{1}{16}$ lea, or	5	62,5
$\frac{1}{40}$ lea, or	2	25
$\frac{1}{80}$ lea, or	1	12,5

N. B.—The worsted reel is 2 yards in circumference, and 40 threads round the reel make 1 lea, and 7 leas make 1 hank.

Required, the weight of 40 yards of a 4 hank roving?

Look opposite 40 yards in the above table, and you will find 500, which is the dividend, and divide by 4, the numbers, or counts of roving, and the quotient will be the weight in grains.

Numbers, or counts of roving, 4 hanks.)500 dividend.

125 grains, or 5 penny-weights, 5 grains, weight required.

WORSTED AND WOOLLEN YARN TABLE.

From Number 41 to 80 hanks in the pound.

	Wgt. of 1 hnk.		Weight of 1 dozen.			Weight of 1 gross.				
Nos.	dwts	grains.	oz.	dwts	grains.	lbs.	oz.	dwts	grains.	Nos.
41	7	2,7	4	12	10,7	3	8	3	13,3	41
42	6	22,6	4	10	10,	3	6	15	15,	42
43	6	18,7	4	8	11,4	3	5	10	14,3	43
44	6	15,	4	6	15,1	3	4	6	14,8	44
45	6	11,5	4	4	20,6	3	3	3	15,5	45
46	6	8,1	4	3	4,	3	2	1	14,	46
47	6	4,9	4	1	13,2	3	1	0	9,3	47
48	6	1,8	4	0	0,	3	0	0	0,	48
49	5	22,8	3	16	17,7	2	15	0	8,9	49
50	5	20,	3	15	7,5	2	14	1	11,	50
51	5	17,2	3	13	22,5	2	13	3	5,2	51
52	5	14,6	3	12	14,8	2	12	5	14,6	52
53	5	12,	3	11	8,4	2	11	8	14,3	53
54	5	9,6	3	10	3,	2	10	12	15,6	54
55	5	7,2	3	8	22,7	2	9	16	5,7	55
56	5	5,	3	7	19,5	2	9	2	14,5	56
57	5	2,8	3	6	17,1	2	8	7	16,2	57
58	5	0,6	3	5	15,7	2	7	13	4,8	58
59	4	22,6	3	4	15,2	2	7	0	22,2	59
60	4	20,6	3	3	15,5	2	6	7	7,	60
61	4	18,7	3	2	16,5	2	5	14	0,1	61
62	4	16,9	3	1	18,3	2	5	2	22,5	62
63	4	15,1	3	0	20,8	2	4	10	10,	63
64	4	13,3	3	0	0,	2	4	0	0,	64
65	4	11,6	2	17	9,3	2	3	8	3,2	65
66	4	10,	2	16	13,7	2	2	16	13,7	66
67	4	8,4	2	15	18,7	2	2	17	1,7	67
68	4	6,9	2	15	0,3	2	1	16	2,	68
69	4	5,4	2	14	6,4	2	1	7	3,2	69
70	4	4,	2	13	13,	2	0	16	16,	70
71	4	2,6	2	12	20,1	2	0	8	5,1	71
72	4	1,2	2	12	3,6	2	0	0	0,	72
73	3	23,9	2	11	11,6	1	15	10	5,7	73
74	3	22,6	2	10	20,1	1	15	2	11,1	74
75	3	21,3	2	10	5,	1	14	13	3,	75
76	3	20,1	2	9	14,2	1	14	5	18,1	76
77	3	18,9	2	8	23,9	1	13	16	19,4	77
78	3	17,7	2	8	9,9	1	13	9	19,5	78
79	3	16,6	2	7	20,3	1	13	3	0,	79
80	3	15,5	2	7	7,	1	12	14	14,	80

Required, the weight of 1 lea of number 36's yarn?

Look opposite 1 lea, or 80 yards, and you will find 1000 which is the dividend, the numbers of yarn, i. e., 36's will be the divisor, and the quotient will be the weight in grains.

Dividend.

Numbers of yarn, 36's)1000(27,77 grains, or 1 dwt., 3¾ grains, weight required.
72

280
252

280
252

280
252

28

If 1 lea, or 80 yards of yarn weigh 27,77 grains; what numbers, or counts will it be?

1000 is the dividend for 1 lea, or 80 yards.

Weight of 1 lea, 27,77 grns.)1000,00(36, numbers, or counts of yarn.
·8333

16666
16666

Required, the weight of 1 hank of number 80's yarn?

7000 is the dividend for 1 hank, or 560 yards.

Numbers of yarn, 8,0)700,0

87,5 grains, or 3 dwts., 15½ grains, weight required.

If 1 hank, or 560 yards, weigh 3 dwts., 15½ grains, or 87,5 grains; what numbers will it be?

7000 is the dividend for 1 hank, or 560 yards.

Weight of 1 hank, 87,5 grns.)7000,0(80, number, or counts of yarn.
7000

0

N. B.—The above examples will be sufficient to illustrate the tables; but if more should be required, see cotton, the only difference being the length constituting the hank.

WORSTED AND WOOLLEN YARNS.

From Number 80 to 120 hanks in the pound.

Nos.	Wgt. of 1 hk. dwts.	grains.	Weight of 1 dozen. oz.	dwts.	grains.	Weight of 1 gross. lbs.	oz.	dwts.	grains.	Nos.
81	3	14,4	2	6	18,	1	12	8	2,4	81
82	3	13,3	2	6	5,4	1	12	1	13,2	82
83	3	12,3	2	5	17,	1	11	13	20,	83
84	3	11,3	2	5	5,	1	11	7	20,5	84
85	3	10,3	2	4	17,2	1	11	1	22,3	85
86	3	9,4	2	4	5,7	1	10	14	9,9	86
87	3	8,4	2	3	18,5	1	10	8	19,2	87
88	3	7,5	2	3	7,5	1	10	3	7,5	88
89	3	6,6	2	2	20,8	1	9	16	4,3	89
90	3	5,7	2	2	10,3	1	9	10	22,5	90
91	3	4,9	2	2	0,	1	9	5	19,4	91
92	3	4,	2	1	14,	1	9	0	19,	92
93	3	3,2	2	1	4,2	1	8	14	2,7	93
94	3	2,4	2	0	18,6	1	8	9	7,4	94
95	3	1,6	2	0	9,2	1	8	4	14,5	95
96	3	0,9	2	0	0,	1	8	0	0,	96
97	3	0,1	1	17	20,4	1	7	13	17,2	97
98	2	23,4	1	17	11,6	1	7	9	7,2	98
99	2	22,7	1	17	2,9	1	7	4	23,3	99
100	2	22,	1	16	18,5	1	7	0	18,	100
101	2	21,3	1	16	10,1	1	6	14	14,1	101
102	2	20,6	1	16	2,	1	6	10	17,3	102
103	2	19,9	1	15	18,	1	6	6	17,4	103
104	2	19,3	1	15	10,2	1	6	2	19,3	104
105	2	18,6	1	15	2,5	1	5	17	4,5	105
106	2	18,	1	14	18,9	1	5	13	9,9	106
107	2	17,4	1	14	11,5	1	5	9	17,	107
108	2	16,8	1	14	4,2	1	5	6	1,8	108
109	2	16,2	1	13	21,1	1	5	2	12,2	109
110	2	15,6	1	13	14,1	1	4	17	5,6	110
111	2	15,	1	13	7,2	1	4	13	19,	111
112	2	14,5	1	13	0,5	1	4	10	10,	112
113	2	13,9	1	12	17,8	1	4	7	2,3	113
114	2	13,4	1	12	11,3	1	4	3	20,1	114
115	2	12,8	1	12	4,9	1	4	0	15,2	115
116	2	12,3	1	11	22,6	1	3	15	17,1	116
117	2	11,8	1	11	16,4	1	3	12	14,8	117
118	2	11,3	1	11	10,3	1	3	9	13,8	118
119	2	10,8	1	11	4,3	1	3	6	14,	119
120	2	10,3	1	10	22,5	1	3	3	15,5	120

Required, the length and weight of number 56's yarn, for a warp 128 yards long, 36 inches wide at the reed, and to have 84 threads in an inch?

128 yards, length of warp.
36 inches, width of warp at the reed.

768
384

4608
84, threads in an inch.

18432
36864

387072, total number of yards of yarn in the warp.

Yards.
1 gross contains 80640 yds.)387072(4 gross.
322560

1 dozen contains 6720 yds.)64512(9 dozen.
60480

1 hank contains 560 yds.)4032(7 hanks.
3920

1 lea contains 80 yds.)112(1 lea.
80

1 thread contains 2 yds.)32

16 threads.

The length of yarn required for the above warp will be 4 gross, 9 dozen, 7 hanks, 1 lea, and 16 threads.

560 yards, 1 hank.
56, numbers of yarn.

3360
2800

31360 number of yards in 1 lb., of 56's yarn.

(Continued.)

WORSTED AND WOOLLEN YARN TABLE.

From Number 121 to 160 hanks in the pound.

Nos	Wgt. of 1 hk. dwts	grains.	Wgt. of 1 dozen. oz.	dwts	grains.	Weight of 1 gross. lbs.	oz.	dwts	grains.	Nos.
121	2	9,8	1	10	16,7	1	3	0	18,	121
122	2	9,3	1	10	11,	1	2	16	3,3	122
123	2	8,9	1	10	5,4	1	2	13	8,1	123
124	2	8,4	1	9	23,9	1	2	10	5,9	124
125	2	8.	1	9	18,5	1	2	7	21,	125
126	2	7,5	1	9	13,1	1	2	5	5,	126
127	2	7,1	1	9	7,9	1	2	2	14,	127
128	2	6,6	1	9	2,7	1	2	0	0,	128
129	2	6,2	1	8	21,6	1	1	15	16,4	129
130	2	5,8	1	8	16,6	1	1	13	4,3	130
131	2	5,4	1	8	11,7	1	1	10	17,1	131
132	2	5,	1	8	6,8	1	1	8	6,8	132
133	2	4,6	1	8	2,	1	1	5	20,7	133
134	2	4,2	1	7	21,3	1	1	3	12,8	134
135	2	3,8	1	7	16,7	1	1	1	5,1	135
136	2	3,4	1	7	12,1	1	0	17	3,7	136
137	2	3,1	1	7	7,6	1	0	14	21,6	137
138	2	2,7	1	7	3,2	1	0	12	16,3	138
139	2	2,3	1	6	22,8	1	0	10	11,8	139
140	2	2,	1	6	18,5	1	0	8	8,	140
141	2	1,6	1	6	14,2	1	0	6	4,9	141
142	2	1,3	1	6	10,	1	0	4	2,5	142
143	2	1,	1	6	5,9	1	0	2	0,9	143
144	2	0,6	1	6	1,8	1	0	0	0.	144
145	2	0,2	1	5	21,8		15	16	5,2	145
146	1	23,9	1	5	17,8		15	14	5,6	146
147	1	23,6	1	5	13,9		15	12	6,6	147
148	1	23,3	1	5	10,		15	10	8,3	148
149	1	23,	1	5	6,2		15	8	10,6	149
150	1	22,6	1	5	2,5		15	6	13,5	150
151	1	22,3	1	4	22,8		15	4	16,9	151
152	1	22,	1	4	19,1		15	2	21,	152
153	1	21,7	1	4	15,5		15	1	1,7	153
154	1	21,4	1	4	11,9		14	17	12,4	154
155	1	21,1	1	4	8,4		14	15	18,3	155
156	1	20,8	1	4	4,9		14	14	0,5	156
157	1	20,5	1	4	1,5		14	12	7,3	157
158	1	20,3	1	3	22,1		14	10	14,7	158
159	1	20,	1	3	18,8		14	8	22,6	159
160	1	19,7	1	3	15,5		14	7	7,	160

Yards. Yards in the warp.
1 lb. of no. 56's=31360)387072(12,34 lbs., or 12 lbs., 5½ oz.
31360 16 oz., 1 lb.

73472 204
62720 34

107520 5,44 oz.
94080 4 qrs., 1 oz.

134400 1,76 qrs.
125440—8960, remainder.

The weight of yarn required for the above warp, will be 12 lbs., 5½ oz. nearly.

Required, the weight of number 66's yarn, to weave a warp 128 yards long, 36 inches wide at the reed, and to have 88 picks, or threads in an inch?

128 yards, length of warp.
36 inches, width of warp at the reed.

768
384

4608
88, number of picks, or threads in an inch.

36864
36864

405504 no. of yds. of yarn reqd. to weave the warp.

Yards. Yards.
1 gross contains 80640)405504(5 gross, 4 hanks, and 32 threads,
403200 length of yarn required to weave the warp.

1 hank contains 560 yards.)2304(4 hanks.
2240

1 thread contains 2 yards.)64

32 threads.

560 yards, 1 hank.
66, numbers of yarn.

3360
3360

36960, number of yards in 1 lb. of 66's yarn.

(Continued.)

WORSTED AND WOOLLEN YARN TABLE.

From Number 161 to 200 hanks in the pound.

	Wght. of 1 hank			Weight of 1 dozen				Weight of 1 gross.				
Nos.	oz	dwts	grains.	lbs.	oz	dwts	grns.	lbs.	oz	dwts	grains.	Nos.
161	1		19,4	1,	3		12,2	14	5		15,5	161
162	1		19,2	1.	3		9,	14	4		1,2	162
163	1		18,9	1.	3		5,8	14	2		11,	163
164	1		18,6	1,	3		2,7	14	0		21,3	164
165	1		18,4	1	2		23,6	13	17		13,6	165
166	1		18,1	1,	2		20,5	13	16		0,7	166
167	1		17,9	1,	2		17,5	13	14		12,4	167
168	1		17,6	1,	2		14,5	13	13		0,5	168
169	1		17,4	1	2		11,5	13	11		13,	169
170	1		17,1	1	2		8,6	13	10		1,9	170
171	1		16,9	1,	2		5,7	13	8		15,2	171
172	1		16,7	1	2		2,8	13	7		4,9	172
173	1		16,4	1	2		0,	13	5		19,	173
174	1		16,2	1	1		21,2	13	4		9,6	174
175	1		16,	1	1		18,5	13	3		0,5	175
176	1		15,7	1	1		15,7	13	1		15,7	176
177	1		15,5	1	1		13,	13	0		7,4	177
178	1		15,3	1	1		10,4	12	17		4,9	178
179	1		15,1	1	1		7,7	12	15		21,2	179
180	1		14,8	1	1		5,1	12	14		14,	180
181	1		14,6	1	1		2,5	12	13		7,	181
182	1		14,5	1	1		0,	12	12		0,4	182
183	1		14,2	1	0		21,5	12	10		18,1	183
184	1		14,	1	0		19,	12	9		12,2	184
185	1		13,8	1	0		16,5	12	8		6,6	185
186	1		13,6	1	0		14,1	12	7		1,3	186
187	1		13,4	1	0		11,7	12	5		20,3	187
188	1		13,2	1	0		9,3	12	4		15,7	188
189	1		13,	1	0		6,9	12	3		11,3	189
190	1		12,8	1	0		4,6	12	2		7,2	190
191	1		12,6	1	0		2,3	12	1		3,4	191
192	1		12,4	1	0		0,	12	0		0,	192
193	1		12,2		18		3,2	11	17		2,3	193
194	1		12,		18		0,9	11	15		23,3	194
195	1		11,8		17		22,7	11	14		20,7	195
196	1		11,7		17		20,5	11	13		18,3	196
197	1		11,5		17		18,4	11	12		16,2	197
198	1		11,3		17		16,2	11	11		14,4	198
199	1		11,1		17		14,1	11	10		12,8	199
200	1		11,		17		12,	11	9		11,5	200

Yards, Yards in the warp.
1 lb. of no. 66's=36960)405504(10 lbs., 15½ oz., weight of weft required to weave the warp.
36960

35904
16 oz, 1 lb.

215424
35904

36960)574464(15 oz.
36960

204864
184800

20064
4 qrs., 1 oz.

36960)80256(2 qrs.
73920

6336

If it requires 12 lbs., 5½ oz. of yarn for a warp, and 10 lbs., 15½ oz. of yarn to weave the warp; what weight will it require for 1 piece, if there be 4 pieces in the warp?

lbs.	oz.	
12 ..	5½	weight of the warp.
10 ..	15½	weight to weave the warp.
No. of pieces in warp, 4)23 ..	5	
5 ..	13¼	weight of 1 piece.

N. B.—The rules, examples, and illustrations laid down for the manufacture of cotton goods, may be applied to the manufacture of any other fabric of cloth, such as linen, worsted, woollen, or silk; the system of calculation being the same, with the exception of the length constituting the lea and hank, all particulars of which will be found in their proper places in this book.

WORSTED AND WOOLLEN YARN TABLE.

From Number 201 to 270 hanks in the pound.

	Wgt. of 1 hnk.		Weight of 1 dozen.			Weight of 1 gross.				
Nos.	dwts	grains.	oz.	dwts	grains.	lbs.	oz.	dwts	grains.	Nos.
201	1	10,8		17	9,9		11	8	10,4	201
202	1	10,6		17	7,8		11	7	9,6	202
203	1	10,4		17	5,8		11	6	9,	203
204	1	10,3		17	3,7		11	5	8,6	204
205	1	10,1		17	1,7		11	4	8,5	205
206	1	9,9		16	23,7		11	3	8,7	206
207	1	9,8		16	21,8		11	2	9,	207
208	1	9,6		16	19,8		11	1	9,6	208
209	1	9,4		16	17,9		11	0	10,4	209
210	1	9,3		16	16,		10	17	17,	210
211	1	9,1		16	14,1		10	16	18,2	211
212	1	9,		16	12,2		10	15	19,7	212
213	1	8,8		16	10,3		10	14	21,3	213
214	1	8,7		16	8,5		10	13	23,2	214
215	1	8,5		16	6,7		10	13	1,3	215
216	1	8,4		16	4,8		10	12	3,6	216
217	1	8,2		16	3,1		10	11	6,1	217
218	1	8,1		16	1,3		10	10	8,8	218
219	1	7,9		15	23,5		10	9	11,7	219
220	1	7,8		15	21,8		10	8	14,8	220
221	1	7,6		15	20,1		10	7	18,	221
222	1	7,5		15	18,3		10	6	21,5	222
223	1	7,3		15	16,6		10	6	1,1	223
224	1	7,2		15	15,		10	5	5,	224
225	1	7,1		15	13,3		10	4	9,	225
226	1	6,9		15	11,6		10	3	13,1	226
227	1	6,8		15	10,		10	2	17,5	227
228	1	6,7		15	8,4		10	1	22,	228
229	1	6,5		15	6,8		10	1	2,7	229
230	1	6,4		15	5,2		10	0	7,6	230
231	1	6,3		15	3,6		9	17	18,1	231
232	1	6,1		15	2,		9	16	23,3	232
235	1	5,7		14	21,4		9	14	15,8	235
240	1	5,1		14	14,		9	10	22,5	240
245	1	4,5		14	6,8		9	7	8,7	245
250	1	4,		14	0,		9	3	22,5	250
255	1	3,4		13	17,4		9	0	15,4	255
260	1	2,9		13	11,		8	15	16,9	260
265	1	2,4		13	5,		8	12	15,7	265
270	1	1,9		12	23,1		8	9	17,3	270

WORSTED COUNT OF REEDS.

THE following are the general acknowledged methods of counting and expressing reeds in the manufacturing of all worsted goods.

1st. The plain back, or 3 ends in a dent, the counts, or fineness of the set, which is expressed by the number of scores, or beers, 20 dents to a beer set on 6-4ths, or 54 inches at the reed. Thus, a 42 contains 42 scores, or 42 beers, 20 dents to a beer, or 840 dents on 54 inches at the reed.

N. B.—This reed is the most common one in use at the present time.

2nd. The wildbore, or 4 ends in a dent, the count, or fineness of the set, which is expressed by the number of scores, or beers, 20 dents to a beer, set on 8-4ths, or 72 inches at the reed. Thus, a 50 wildbore slaie, or reed, contains 50 scores, or 50 beers, 20 dents to a beer, or 1000 dents on 72 inches at the reed.

N. B.—This method is very little in use now.

3rd. The 2 ends in a dent is coming more into use, the fineness of the set, which is expressed by the number of scores, or beers, 20 dents to a beer set on 4-4ths, or 36 inches at the reed.

4th. Lastings. The count, or fineness of the set, which is expressed by the number of dents set on 30 inches at the reed. Thus, a 4 contains 400 dents, a 4½ contains 450 dents, &c., &c.

The following tables will shew the count, or fineness of worsted reeds, according to the number of dents in an inch, and the different systems of counting.

EXPLANATION TO THE REED TABLES.

The first line in each division contains the number of dents in an inch; opposite to which in the table is the count of the reed, according to the different systems of counting.

N.B.—The decimal in the line expressing the number of dents in an inch, is the decimal of a dent. Thus, 20,5 *is equal to* 20½ *dents, and the decimal in the lines expressing the counts of the reeds, is the decimal of a score, or beer containing* 20 *dents. Thus,* 40,5 *is equal to* 40½ *scores, or beers.*

WORSTED REED TABLE.

Dents in 1 inch.	Leaves, or hers on 24 inches.	Leaves, or hers on 72 ins.	Leaves, or hers on 36 inches.	Dents in 30 inches.	Dents in 1 inch.	Leaves, or hers on 24 inches.	Leaves, or hers on 72 inches.	Leaves, or hers on 36 inches.	Dents in 30 inches.
8,	21,6	28,8	14,4	240	25,5	68,85	91,8	45,9	765
8,5	22,95	30,6	15,3	255	26,	70,2	93,6	46,8	780
9,	24,3	32,4	16,2	270	26,5	71,55	95,4	47,7	795
9,5	25,65	34,2	17,1	285	27,	72,9	97,2	48,6	810
10,	27,	36,	18,	300	27,5	74,25	99,	49,5	825
10,5	28,35	37,8	18,9	315	28,	75,6	100,8	50,4	840
11,	29,7	39,6	19,8	330	28,5	76,95	102,6	51,3	855
11,5	31,05	41,4	20,7	345	29,	78,3	104,4	52,2	870
12,	32,4	43,2	21,6	360	29,5	79,65	106,2	53,1	885
12,5	33,75	45,	22,5	375	30,	81,	108,	54,	900
13,	35,1	46,8	23,4	390	30,5	82,35	109,8	54,9	915
13,5	36,45	48,6	24,3	405	31,	83,7	111,6	55,8	930
14,	37,8	50,4	25,2	420	31,5	85,05	113,4	56,7	945
14,5	39,15	52,2	26,1	435	32,	86,4	115,2	57,6	960
15,	40,5	54,	27,	450	32,5	87,75	117,	58,5	975
15,5	41,85	55,8	27,9	465	33,	89,1	118,8	59,4	990
16,	43,2	57,6	28,8	480	33,5	90,45	120,6	60,3	1005
16,5	44,55	59,4	29,7	495	34,	91,8	122,4	61,2	1020
17,	45,9	61,2	30,6	510	34,5	93,15	124,2	62,1	1035
17,5	47,25	63,	31,5	525	35,	94,5	126,	63,	1050
18,	48,6	64,8	32,4	540	35,5	95,85	127,8	63,9	1065
18,5	49,95	66,6	33,3	555	36,	97,2	129,6	64,8	1080
19,	51,3	68,4	34,2	570	36,5	98,55	131,4	65,7	1095
19,5	52,65	70,2	35,1	585	37,	99,9	133,2	66,6	1110
20,	54,	72,	36,	600	37,5	101,25	135,	67,5	1125
20,5	55,35	73,8	36,9	615	38,	102,6	136,8	68,4	1140
21,	56,7	75,6	37,8	630	38,5	103,95	138,6	69,3	1155
21,5	58,05	77,4	38,7	645	39,	105,3	140,4	70,2	1170
22,	59,4	79,2	39,6	660	39,5	106,65	142,2	71,1	1185
22,5	60,75	81,	40,5	675	40,	108,	144,	72,	1200
23,	62,1	82,8	41,4	690	40,5	109,35	145,8	72,9	1215
23,5	63,45	84,6	42,3	705	41,	110,7	147,6	73,8	1230
24,	64,8	86,4	43,2	720	41,5	112,05	149,4	74,7	1245
24,5	66,15	88,2	44,1	735	42,	113,4	151,2	75,6	1260
25,	67,5	90,	45,	750	42,5	114,75	153,	76,5	1275

To ascertain the count, or fineness of worsted reeds.

RULE.—Multiply the number of dents in an inch by the given number of inches any reed is set on, according to the system of counting, and divide by 20 which is the number of dents in a score, or beer, and the quotient will be the count, or fineness of the reed, and if the number of dents in an inch at the reed be required, multiply the count of the reed by 20, and divide by the given number of inches the reed is set on, and the quotient will be the number of dents in an inch, according to the fineness of the reed, and the system of counting.

The system of ascertaining the count, or fineness of reeds for lastings, differs from the others, but will be found by multiplying the number of dents in an inch by 30, the product of which will be the count, or fineness of the reed, and if the number of dents in an inch be required, divide the count, or fineness of the reed by 30, and the quotient will be the number of dents in an inch, according to the fineness of the reed.

EXAMPLES.

The count, or fineness of the plain back reed containing 19 dents in an inch is required?

19, dents in an inch.
54, number of inches the reed is set on.

76
95

Score, or beer, 20 dents.)102,6

51,3, or 51 scores, or beers, and 6 dents set on 54 inches at the reed, or nearly 51½ count, or fineness of the reed.

What number of dents will there be in an inch of a 51,3 plain back reed?

51,3, count of reed.
20 dents, 1 score, or beer.

No. of inches reed set on, 54)1026,0(19, number of dents in an inch at the reed.
54

486
486

WORSTED REED TABLE.

Dents in 1 inch.	Scores, or hers in 54 inches.	Scores, or hers in 72 inches.	Scores, or hers in 36 inches.	Dents in 30 inches.	Dents in 1 inch.	Scores, or hers in 54 inches.	Scores, or hers in 72 inches.	Scores, or hers in 36 inches.	Dents in 30 inches.
43,	116,1	154,8	77,4	1290	60,5	163,35	217,8	108,9	1815
43,5	117,45	156,6	78,3	1305	61,	164,7	219,6	109,8	1830
44,	118,8	158,4	79,2	1320	61,5	166,05	221,4	110,7	1845
44,5	120,15	160,2	80,1	1335	62,	167,4	223,2	111,6	1860
45,	121,5	162,	81,	1350	62,5	168,75	225,	112,5	1875
45,5	122,85	163,8	81,9	1365	63,	170,1	226,8	113,4	1890
46,	124,2	165,6	82,8	1380	63,5	171,45	228,6	114,3	1905
46,5	125,55	167,4	83,7	1395	64,	172,8	230,4	115,2	1920
47,	126,9	169,2	84,6	1410	64,5	174,15	232,2	116,1	1935
47,5	128,25	171,	85,5	1425	65,	175,5	234,	117,	1950
48,	129,6	172,8	86,4	1440	65,5	176,85	235,8	117,9	1965
48,5	130,95	174,6	87,3	1455	66,	178,2	237,6	118,8	1980
49,	132,3	176,4	88,2	1470	66,5	179,55	239,4	119,7	1995
49,5	133,65	178,2	89,1	1485	67,	180,9	241,2	120,6	2010
50,	135,	180,	90,	1500	67,5	182,25	243,	121,5	2025
50,5	136,35	181,8	90,9	1515	68,	183,6	244,8	122,4	2040
51,	137,7	183,6	91,8	1530	68,5	184,95	246,6	123,3	2055
51,5	139,05	185,4	92,7	1545	69,	186,3	248,4	124,2	2070
52,	140,4	187,2	93,6	1560	69,5	187,65	250,2	125,1	2085
52,5	141,75	189,	94,5	1575	70,	189,	252,	126,	2100
53,	143,1	190,8	95,4	1590	70,5	190,35	253,8	126,9	2115
53,5	144,45	192,6	96,3	1605	71,	191,7	255,6	127,8	2130
54,	145,8	194,4	97,2	1620	71,5	193,05	257,4	128,7	2145
54,5	147,15	196,2	98,1	1635	72,	194,4	259,2	129,6	2160
55,	148,5	198,	99,	1650	72,5	195,75	261,	130,5	2175
55,5	149,85	199,8	99,9	1665	73,	197,1	262,8	131,4	2190
56,	151,2	201,6	100,8	1680	73,5	198,45	264,6	132,3	2205
56,5	152,55	203,4	101,7	1695	74,	199,8	266,4	133,2	2220
57,	153,9	205,2	102,6	1710	74,5	201,15	268,2	134,1	2235
57,5	155,25	207,	103,5	1725	75,	202,5	270,	135,	2250
58,	156,6	208,8	104,4	1740	75,5	203,85	271,8	135,9	2265
58,5	157,95	210,6	105,3	1755	76,	205,2	273,6	136,8	2280
59,	159,3	212,4	106,2	1770	76,5	206,55	275,4	137,7	2295
59,5	160,65	214,2	107,1	1785	77,	207,9	277,2	138,6	2310
60,	162,	216,	108,	1800	77,5	209,25	279,	139,5	2325

The count, or fineness of a wildbore reed containing 19 dents in an inch, is required? 19 dents in an inch.
72, number of inches the reed is set on.

38
133

Score, or beer, 2,0 dnts.)136,8

68,4 count, or fineness of the reed, i. e., 68 scores, or beers, and 8 dents, or 1368 dents set on 72 inches at the reed.

What number of dents will there be in an inch of 68,4 wildbore reed? 68,4, count of reed.
20 dents, 1 score, or beer.

No. of inches reed set on, 72)1368,0(19, number of dents in an inch at the reed.
72

648
648

The count, or fineness of a reed, is required from the following particulars?

Number of inches the reed is set on, 36.
Number of dents in an inch, 19.
Number of dents in a score, or beer, 20.
19, dents in an inch.
36, number of inches the reed is set on.

114
57

Score, or beer, 2,0 dents.)68,4

34,2, count, or fineness of the reed, i. e., 34 scores, or beers, and 4 dents, set on 36 inches at the reed.

If 34 scores, or beers, and 4 dents be set on 36 inches at the reed; how many dents will there be in an inch?
Beers. Dents.
34 .. 4
20, number of dents in a beer.

No. of inches reed set on, 36)684(19, number of dents in an inch at the reed.
36

324
324

The count, or fineness of lasting reed containing 19 dents in an inch, is required?

19, dents in an inch.
30, number of inches the reed is set on.

570, or nearly $5\frac{3}{4}$ count, or fineness of the reed.

If a lasting reed contains 570 dents; how many dents will there be in an inch?

No. of inches reed set on, 3,0)57,0 dents.

19, number of dents in an inch at the reed.

How many dents will there be in an inch of a 50 plain back reed?

50, count of reed.
20 dents, 1 score, or beer.

No. of inches reed set on, 54)1000(18,518, or rather more than $18\frac{1}{2}$ dents in an inch at the reed.

54

460
432

280
270

100
54

460
432

28

N.B.—Warps are warped quite independent of the set for which they may be used. The common way of warping is by portits, portives, porters, or beers, whichever they may be called. The name most in use at Bradford, is portit, of 50 ends each. Some warp by 48 ends, and lasting warps are generally warped by 48. Of course it does not matter in what numbers they are warped, if the warp only contains the number of ends required, according to the width and fineness of the reed.

MISCELLANEOUS QUESTIONS.

The revolutions per minute of a shaft, are required from the following particulars?

Double strokes of steam engine, 19½ per minute.

Wheel on crank, or fly shaft, 64 teeth, working into a wheel 49 teeth on the first line of shafts.

Wheel 63 teeth on the first line of shafts, works into a wheel 36 teeth on foot of an upright shaft. Then, wheel 70 teeth on the top of the upright shaft, works into a wheel 39 teeth on lying shaft; the speed of which is required.

Driving wheels, &c.

19,5 double strokes, engine makes per minute.
64 teeth, wheel on fly, or crank shaft.

780
1170

1248,0
63 teeth, wheel on first lying shaft.

3744
7488

78624
70 teeth, wheel on top of upright shaft.

5503680 dividend.

(See next page.)

Driven wheels.
49 teeth, wheel on first lying shaft.
36 teeth, wheel on foot of upright shaft.

294
147

1764
39 teeth, wheel on lying shaft, the speed of which is required.

15876
5292

68796 divisor.

68796)5503680(80 revolutions per minute, speed of shaft required.
550368

0

Suppose a shaft be making 80 revolutions per minute, with the following driving and driven wheels on the intermediate shafts; what number of double strokes per minute should the engine make?

Driving wheels, &c.
80, revolutions of given shaft per minute.
39 teeth, wheel on do.

720
240

3120
36 teeth, wheel on foot of upright shaft.

18720
9360

112320
49 teeth, wheel on the first lying shaft.

1010880
449280

5503680 dividend.

(Continued.)

Driven wheels.
70 teeth, wheel on top of upright shaft.
63 teeth, wheel on first lying shaft.

210
420

4410
64 teeth, wheel on crank, or fly shaft.

17640
26460

282240 divisor.

282240)5503680(19,5, double strokes of steam
282240 engine per minute.

2681280
2540160

1411200
1411200

If a drum 42¼ inches diameter, drives the beaters of a blowing machine 1344 revolutions per minute; what must the diameter of a drum be, for the beaters to make 1560 revolutions, and if the present drum is to be lagged, what thickness must the lags be?

Revols. Inches. Revols.
If 1344 .·. 42,25 .·. 1560
1560

253500
21125
4225

1344)65910,00(49,04 inches, diameter of drum reqd.
5376

12150
12096

5400
5376

24

(Continued.)

49,04 inches, diameter of drum required.
42,25 inches, diameter of given drum.

2)6,79 inches, difference of diameters of drums.
3,395, or nearly 3,4 inches, thickness of lags required.

If a drum 42¼ inches diameter, drives the beater of a blowing machine 1344 revolutions per minute; what number of revolutions will the beater make if driven from a drum $49\frac{1}{2}$ inches diameter?

Inches. Revols. Inches.
If 42¼ or 42,25 ∴ 1344 ∴ ∴ 49,04, or $49\frac{1}{2}$

49,04

5376
120960
5376

42,25)65909,76(1560, revolutions of beater per minute, nearly.
4225

23659
21125

25347
25350—nearly

If a pulley 13 inches diameter, drives the main cylinder of a carding engine, at the rate of 126 revolutions per minute; what diameter must the pulley be, to reduce the speed of the cylinder to 112 revolutions?

(See next page.)

126, revolutions given.
13 inches, diameter of given pulley.

378
126

Revolutions required, 112)1638(14,625, or 14⅝ inches, diameter of
112 pulley required.

518
448

700
672

280
224

560
560

How many grains will 30 yards of 3¼ hank roving weigh ?

Hank roving, 3,25)250,00(76,92 grains, or 3 dwts., 5 grains,
2275 nearly.

2250
1950

3000
2925

750
650

100

If 30 yards, or 1-4th of a lea weigh 76,92 grains; what hank roving will it be?

30 yards of roving weigh 76,92)250,00(3,25, or $3\frac{1}{4}$ hank roving.

23076

19240
15384

38560
38460

100

The weight of 1 pair of sets of cops is required, from the following particulars?

Number of spindles in pair of wheels, 1016.
Length of stretch put up, (breakage allowed,) $61\frac{1}{2}$ inches.
Number of stretches, 900.
Number of yarn 36's.

1016 x 900 x 61,5=56235600,0 dividend.
840 x 36 x 36=1088640, divisor.

56235600 divided by 1088640=51 lbs., $10\frac{1}{2}$ oz., weight of pair of sets.

How many hanks, leas, and yards, will there be in a pair of sets of cops, of which the following are the particulars?

Number of spindles in wheels, 808.
Number of stretches on set, 450.
Net length of stretch put up, $57\frac{1}{2}$ inches.

808, number of spindles in wheels.
450, stretches on set.

40400
3232

363600
57,5, or $57\frac{1}{2}$ inches, length of stretch put up.

1818000
2545200
1818000

1 yard, 36 inches. { 6)20907000,0 number of inches on pair of sets.

6)3484500

1 lea is 12,0 yards.)58075,0 yards.

1 hank is 7 leas.)4839 leas, and 70 yards.

691 hanks, 2 leas, and 70 yards, length on pair of sets.

If there be 691 hanks, 2 leas, and 70 yards on 1 pair of sets of number 36's pincop weft; what weight will they be?

1 lea is 12,0 yards.)70,0 yards.

1 hank is 7 leas.)2,5833 leas.

691,36904 hanks, divided by 36=19 lbs., 3¼ oz., weight of 691 hanks, 2 leas, and 70 yards of 36's weft.

If 20 ounces of cotton were fed on 30 inches of feed cloth at lap machine, and to pass through all the operations of working without loss; what numbers of yarn would it produce, allowing the following draughts and doublings?

437,5 grains, 1 oz.
20 ounces, weight of cotton fed on feed cloth.

Draught at lap machine, 2)8750,0 grains, do.

Draught at card. engine, 12,0)437,5 grains, weight of 30 inches of lap.

36.458333 grains, weight of 30 inches of carding.
No. of ends put up at 1st drawing, 6

Dght. 1st hd. of drng., 6,25)218,750000(35 grains weight of 30 inches, at the 1st head of drawings
1875
3125
3125

35 gns., wgt. of 30 in. of drng. 1st head.
6, no. of ends put up at 2nd. hd. of dngs.

Draught at the 2nd head of drawings, 6,3)210(33,33 grains, weight of 30 inches of drawing at 2nd head.
189
210
189
21

(Continued.)

33,33 gns. wgt. of 30 in. drag. 2nd hd.
8, number of ends put up at 3rd head of drawings.

Dght. at 3rd hd. drags., 6,4)265.56(41,666 grns., weight of 30 inches of drawing at 3rd head.
256

106
64

426
384

426 426
384 384

426 42

Draught at slubbing frame, 5)41,66 grains, weight of 30 inches of drawing, 3rd head.

8,33 gns., wght. of 30 in. of slubbing.
2, no. of ends put up at rov. frame.

Draught at roving frame, 7)16,66

2,38095 grains, weight of 30 inches of roving.

Grains.
Draught at spinning, 11,5)2,38095(,20704, decimal of a grain weight, of 30 inches of yarns.
230

809
805

450
460—nearly.

,20704 grain, weight of 30 inches of yarn.
36, a multiplier for 30 yards.

124224
62112

7,45344 grains, weight of 30 yards of yarn.
4—4 times 30 yards = 1 lea.

29,81376 grains, weight of 1 lea of yarn.

The weight of cotton, according to the foregoing draughts and doublings, required to produce 1 lea of yarn is, 29,81376 grains, or 1 dwt., 5,81376 grains.

Weight of 1 lea, 29,81376 grns.)1000,00000(33,54 hanks in 1 lb.

8944128

10558720
8944128

16145920
14906880

12390400
11925504

464896

33,54 hanks = 1 lb.
8,385 hanks = 4 ounces.

41,925 hanks = 20 ounces.
7 leas = 1 hank.

293,475
29,8137 grains = 1 lea.

2054325
880425
293475
2347800
2641275
586950

8749,5756075 grains weight, or 20 ounces fed on 30 inches of feed cloth at lap machine.

If 20 ounces of cotton fed on 30 inches of feed cloth at lap machine produces number 36's twist, or weft, according to the following draughts and doublings; what will the loss sustained in working be?

Draught at the lap machine, 2.
Draught at the carding engine, 120.
Draught at the 1st head of drawings, 6,25.

(See next page.)

Draught at the 2nd head of drawings, 6,3.
Draught at the 3rd head of drawings, 6,4.
Draught at the slabbing frame, 5.
Draught at the roving frame, 7.
Draught at the spinning, 11,5.
Multiplier for 30 inches, 6,944.

Doublings at the 1st head of drawings, 6.
Doublings at the 2nd head of drawings, 6.
Doublings at the 3rd head of drawings, 8.
Doublings at the roving frame, 2.
Numbers of yarn produced, 36's.

Draughts.

2, lap machine.
120, carding engine.

240
6,25, first head of drawings.

1200
480
1440

1500,00
6,3, second head of drawings.

4500
9000

9450,0
6,4, third head of drawings.

37800
56700

60480,0
5, slabbing frame.

302400
7, roving frame.

2116800

(Carried to next page.)

2116800
11,5 mules.

10584000
23284800

24343200,0
Multiplier for 30 in., as per table, 6,944

97372800
97372800
219088800
146059200

169039180,800 dividend.

Doublings.
6 x 6 x 8 x 2 x 36=20736 divisor.

169039180,8 divided by 20736=8152 grains, or 18 oz., 11 dwts., 13 grains, weight of yarn produced from 20 oz. of cotton.

	oz.	dwts.	grs.
Weight of cotton fed on feed cloth at lap machine,	20	0	0
Weight of yarn produced, - - - -	18	11	13
Loss sustained in working, - - - -	1	6	16,5

Suppose there be a 48 teeth wheel working into a 36 teeth wheel, and finding them of a finer pitch than they should be; what wheels will work in the same place to produce the same speed with the same diameters of wheels?

RULE.—Reduce the wheels to their lowest terms, by dividing them by any number that will divide the number of teeth in the wheels without a remainder; then multiply the lowest terms of the wheels by any one number that will produce the number of teeth required.

Thus,

12)48	12)36
Lowest term, 4	3 lowest term.

(See next page.)

Lowest term, 4 — 3 lowest number.
2 — 2

Wheel, 8 teeth, and wheel 6 teeth.

Lowest term, 4 — 3 lowest term.
3 — 3

Wheel, 12 teeth, and wheel 9 teeth.

Lowest term, 4 — 3 lowest term.
4 — 4

Wheel, 16 teeth, and wheel, 12 teeth.

Lowest term, 4 — 3 lowest term.
5 — 5

Wheel, 20 teeth, and wheel, 15 teeth.

Lowest term, 4 — 3 lowest term.
6 — 6

Wheel, 24 teeth, and wheel, 18 teeth.

Lowest term, 4 — 3 lowest term.
9 — 9

Wheel, 36 teeth, and wheel, 27 teeth.

N. B—The same system will answer, either for increasing, or decreasing the number of teeth in wheels.

Any of the above wheels working together will produce the same speed.

F. A. CALVERT'S MACHINE FOR OPENING AND CLEANING COTTON, AND BURRING WOOL, &c.

Plate 1 is a side elevation, 1-16th of its true size, correctly drawn from its newest construction.

This Machine differs from all others used for the like purposes; inasmuch as all fibre cleaned on it is passed through a contracted space, so small, that all motes, seeds, &c., &c., are thrown down beneath it, making the operation of cleaning exceedingly simple and cheap.

The construction is as follows:—

In that part of the Machine where the dirt is separated from the fibre, it consists of two revolving cylinders connected, and made adjustable. The first of these cylinders, and the one which takes hold of the fibre, contains a series of fine combs embedded in its surface, the teeth of which are in perfect longitudinal lines along the cylinder, and also true and curved to its surface, with depressed channels along the front of each row of teeth, and so small, that all motes, seeds, &c., are left projecting above its periphery, and brought up to the contracted space, and there combed off by the second cylinder, which differs from the first, inasmuch as the fine rows of teeth which comb or pick out the motes are at right angles from its centre.

The diameter of these cylinders is 12 and 9 inches, and usually 3 feet long, making 500 revolutions each, per minute. Therefore it will be easily seen, by the practical Manufacturer, that very little power is needed, compared with the old system,—the power required for cleaning 3,000lbs. of cotton per day, being from 1 to 1½ horses, according to the state of the material.

Plate 2 is a modification of the Cleaning Machine already described, as applied to the carding engine, and used as a taker-in.

This patent cylinder, used in this particular way, varies in its construction (though same in principle), from the first cylinder described in the Cleaning Machine.

Instead of using combs with longitudinal teeth; they are cut on

flattened iron or steel wire, after which they are wound into crevices cut in the surface of a metallic roller or cylinder, and properly staked or fastened. Each row of teeth is placed so near together that dirt cannot get into them, thereby forming a cylinder almost endless in its duration, and most perfect in its operation.

It will be seen, by reference to the drawing, there is a roller connected underneath, covered with suitable card clothing, and commonly called a dirt catcher, made self stripping, this roller being made to move backwards, at a very slow speed, say 1 to 1½ revolutions per hour.

Having described these machines when connected with Cotton, both as to cleaning it in its raw state, and also when applied to the card, we shall proceed to make a few remarks respecting its qualities when applied to opening, cleaning, and carding Wool.

Plate 1, as shewn and described, when used for cotton is but slightly altered in its internal arrangements, so as to make it a very perfect machine for opening and cleaning all kinds of dyed and dusty, but more particularly for foreign or burry wools.

This machine is so constructed that it can be readily cleansed after cleaning colored, so as to prepare for white wools; it is also well adapted for wools while in a state of animal grease, or when oiled previous to going to the carding engine.

Plate 3, fig. 1, is another modification of the patent cylinder described at plate 2 (for Cotton), but now arraged for the purpose of moting, cleaning, and carding, as applied to a fine wool carding engine, and takes the place of what is commonly called leader, taker-in, or breast, connected first with a cylinder, containing elevations, or ribs, for the purpose of striking off any burs, seeds, motes, or other extraneous matter presented to their edges by the patent cylinder or taker-in, into a box or receptacle placed longitudinally above the feeding rollers, and is shewn by a sectional line in plate 2.

The two small cylinders working in conjunction with the patent cylinder and stripper, perform the office of what is commonly called workers, and are continuously stripped by the above-named patent cylinder and stripper, the said stripper delivering the fibre to the main cylinder of the card,—their respective motion is shown and indicated by arrows.

This application, as delineated and shewn, has proved itself to be a most efficient and perfect machine for the purpose to which it is applied.

Plate 3, fig. 2, is a diagram to assist in forwarding orders. The arrow indicates the direction the cylinder revolves. The width of the main cylinder is 60 inches, and the length of shaft necessary to accommodate it to the frame of card and drive advantageously, 9 and 12 inches.

Plate 4, fig. 1, is another modification of the same patent cylinder, when used as a taker-in and applied to worsted (or any other long wool) carding engines.

The principal difference consists in putting the cylinders, containing elevations or ribs, below the patent cylinder, and thereby striking all burs, seeds, and other extraneous matter, to the floor, instead of into the box, as described in plate 3, fig. 1.

Plate 4, fig. 2, is a diagram with a cylinder 48 inches.

JUDKINS' AMERICAN HEALDS, OR PATENT HEDDLES.

The machine shewn in the drawing is so constructed as to double and twist the yarn from single of itself, and at the same time, at certain points, is converted into a braiding or platting machine, by which the eye or loop of the heddle is formed, without knots of any description.

The advantages of this machine are many. A set of healds is produced by it at a much less cost than by any other method, and without a single knot at any point, the whole being one continuous twine or cord.

By the drawing is also shewn a set of healds made by this machine, with the eye or loop as described, which is coated, lined, or covered with a metallic substance, suitable for the purpose.

One set of patent healds will last fifteen of any other kind, and a greater number of yards of cloth, heavier and more perfect, can be produced through it, in a given time, in consequence of less friction upon the warp.

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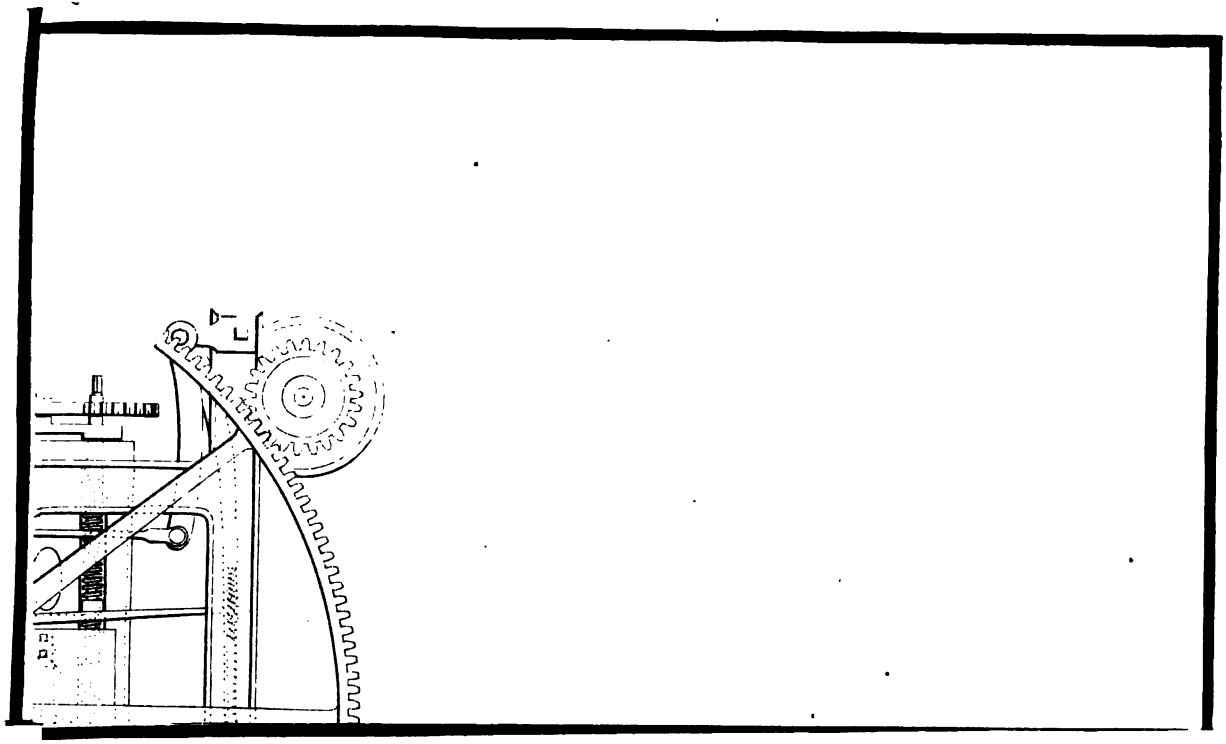

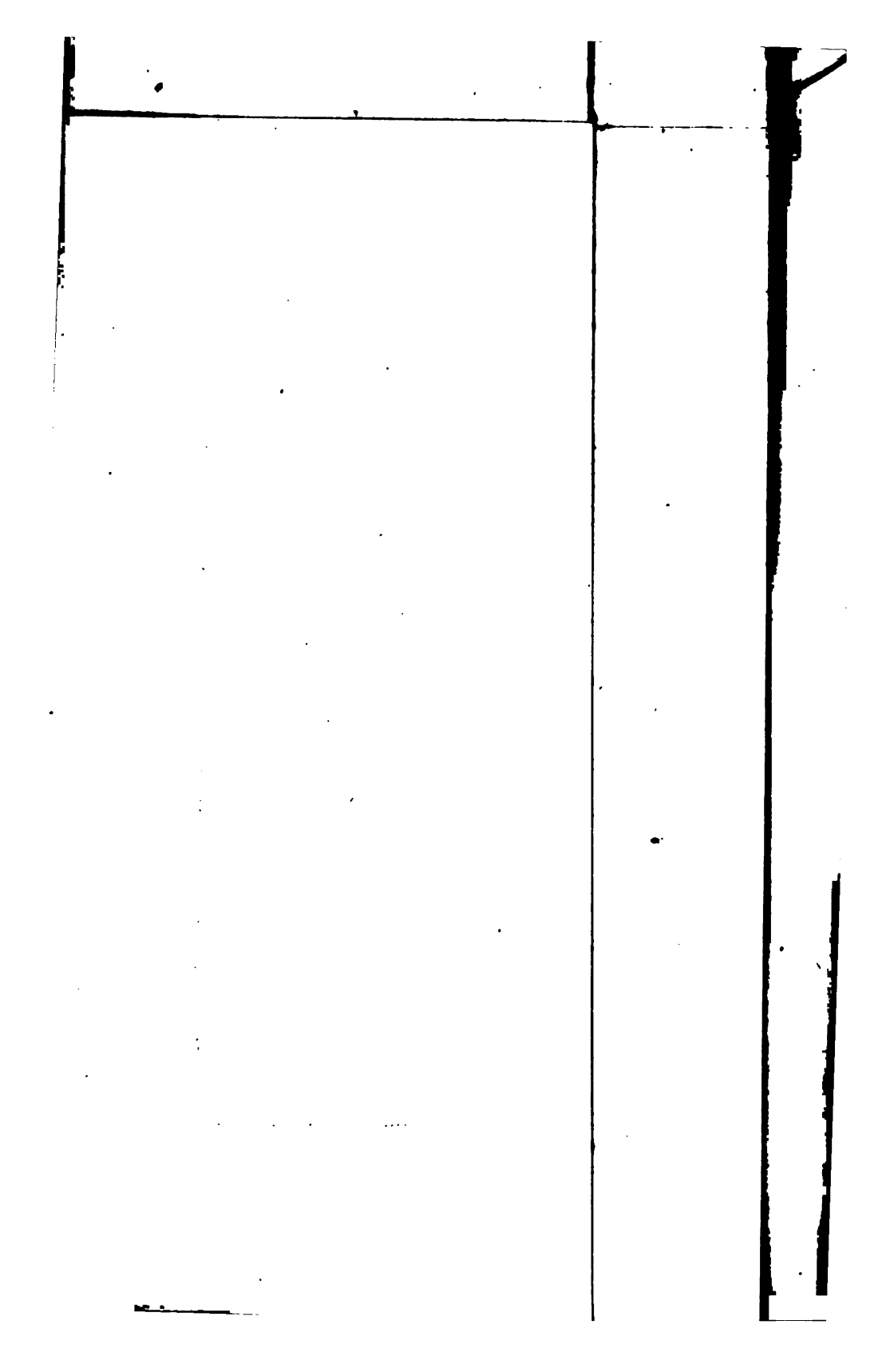

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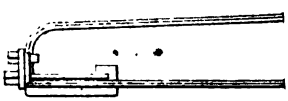

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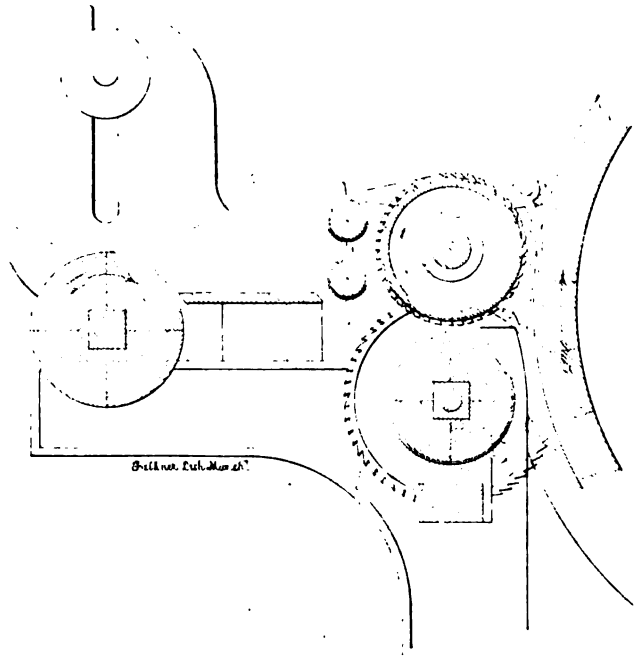
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FIG. 1.

Plate 3.

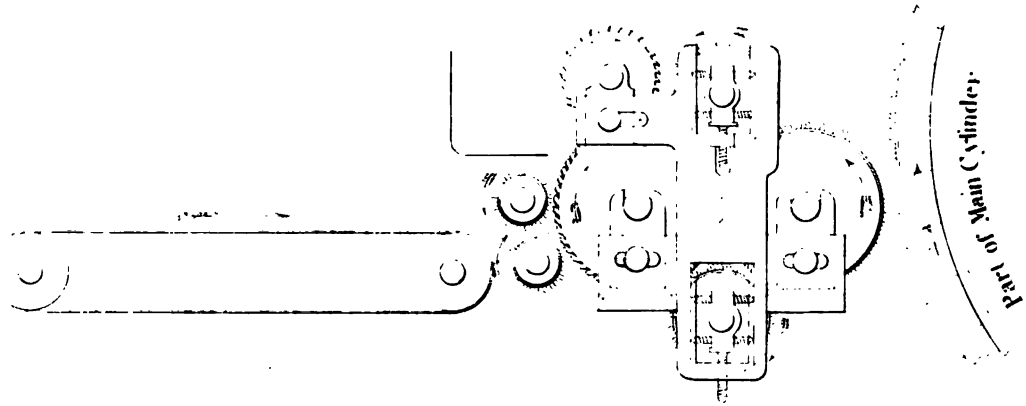


FIG. 2.

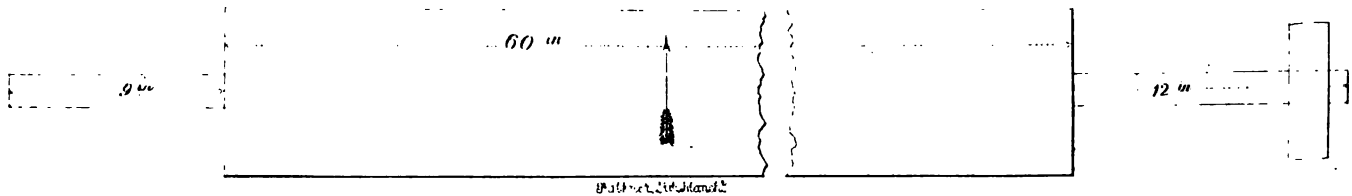


FIG. 1.

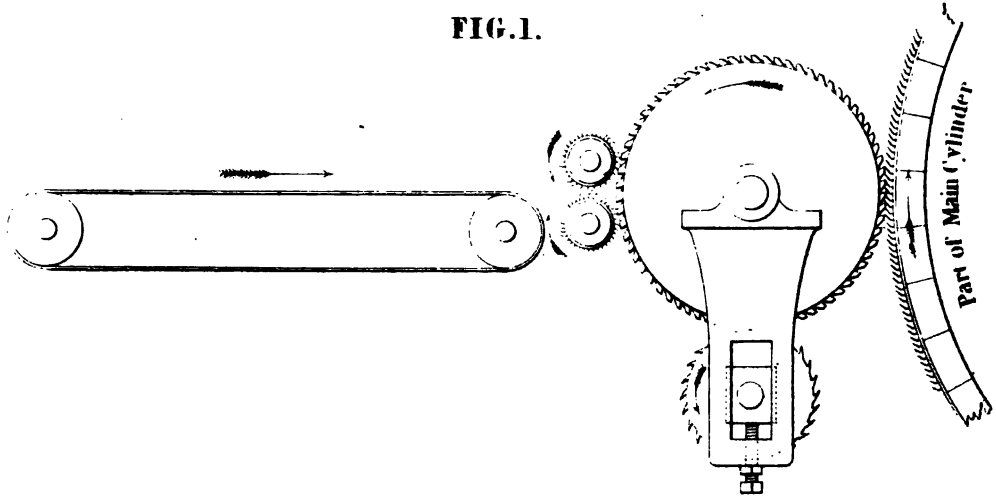
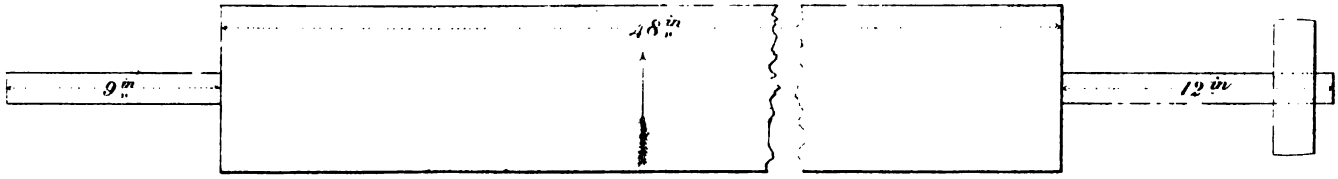
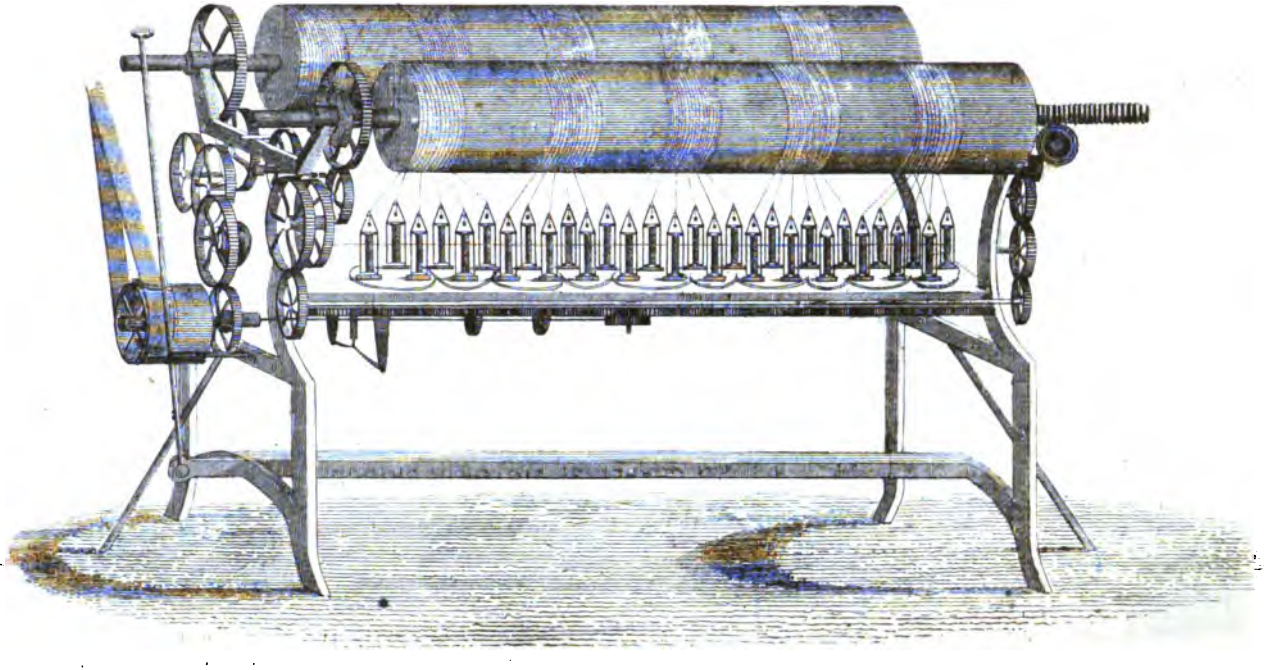
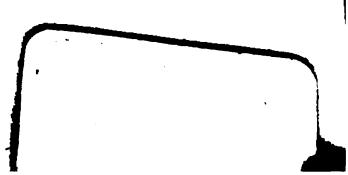


FIG. 2.



C. T. JUDKINS' PATENT HEALDS OR HEDDLES.

MACHINE FOR MANUFACTURING THE ABOVE HEDDLES.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